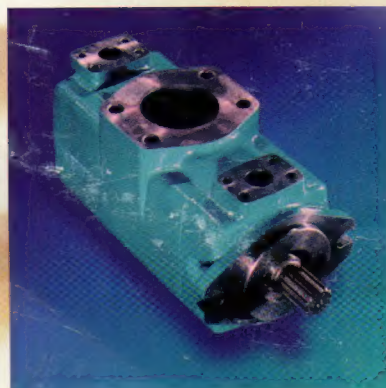


**VICKERS**



# HYDRAULICS *and* ELECTRONICS



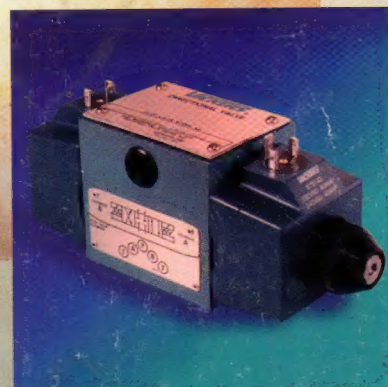
**Electrohydraulic**

**Controls:**

**Servo Valves**

**Proportional valves**

**Electronics**



5117.03/EN/0198/A





## **Electrohydraulic Controls:**

**Servo Valves**

**Proportional Valves**

**Electronics**

**A**

**B**

**C**





## Electrohydraulic Controls: Servo Valves – Section A

	<b>Catalog Number</b>	<b>Page Number</b>
For full information on the range of valves, see the following separate catalogs:		
SM4-10/12/15	651	A.1
SM4-20	652	A.3
SM4-20 (-50)	662	A.5
SM4-30	653	A.7
SM4-40	654	A.9
SX4	650	A.11
Amplifiers, Power Systems, Function Modules & Controllers	656	A.13
SM4 & SX4 Installation and Troubleshooting	657	A.15







## SM4-10/12/15 Servovalves

Flows to 57 l/min (15 USgpm) — Pressures to 210 bar (3000 psi)



Refer to separate catalog 651

# Introduction

Vickers SM4-10/12/15 servovalves can provide system closed loop control with exact positional accuracy, repeatable velocity profiles, and predictable force or torque regulation.

Typical applications include plastic injection molding and blow molding systems, test and simulation equipment, die casting machines, hydraulic press brakes, animation and entertainment equipment, oil exploration vehicles, and lumber machinery.

The three models in this size of the high performance SM4 series offer a wide range of rated flows from 3,8 to 57 l/min (1.0 to 15 USgpm) at  $\Delta p$  of 70 bar (1000 psi).

The SM4 is a two-stage, modular design, flow control valve which can be manifold or subplate mounted. A symmetrical, dual coil, quad air gap torque motor is integrally mounted to the first stage nozzle flapper pilot valve with six screws. The second stage utilizes a four-way sliding spool and sleeve arrangement with a mechanical null adjust. Spool position is fed back to the first stage by means of a cantilever spring. An integral 35 micron (absolute) filter protects against contamination of the pilot stage.

An SM4 servovalve, used with a hydraulic cylinder, position transducer, and appropriate electronics, can provide infinite cylinder position control to within 0,025 mm (0.001 in) or better (depending on component selection, length of stroke, and load characteristics).

When applied with servo hydraulic motors, tachometers, and appropriate electronics, the SM4 provides infinite proportional flow control for real-time velocity/acceleration profiles that can be closed loop error corrected to within one-tenth of a revolution per minute. With appropriate pressure transducers or load cells, cylinders, and electronics in force control applications, the SM4 offers exact load pressure/force control and excellent system stability with pressure and load to  $\pm 1\%$  full scale.

The field-proven design of the SM4-10/12/15 servovalves, combined with Vickers precision manufacturing techniques, provides you with the optimum in system control.

## Contents of Catalog

Operating Data

Performance Curves

Model Code

Installation Dimensions

SM4M(E) Mounting Subplates

SM4A Adapter Manifolds

SM4FV Flushing Valves

Weights

Additional Accessories

Application Data





## SM4-20 Servovalves

Flows to 76 l/min (20 USgpm) — Pressures to 210 bar (3000 psi)



Refer to separate catalog 652

# Introduction

Vickers SM4-20 servovalves can provide system closed loop control with exact positional accuracy, repeatable velocity profiles, and predictable force or torque regulation.

Typical applications include plastic injection molding and blow molding systems, test and simulation equipment, die casting machines, hydraulic press brakes, animation and entertainment equipment, oil exploration vehicles, and lumber machinery.

This model of the high performance SM4 series offers a wide range of rated flows from 3,8 to 76 l/min (1.0 to 20 USgpm) at  $\Delta p$  of 70 bar (1000 psi).

The SM4 is a two-stage, modular design, flow control valve which can be manifold or subplate mounted. The symmetrical, dual coil, quad air gap torque motor is integrally mounted to the first stage nozzle flapper pilot valve with six screws. The second stage utilizes a four-way sliding spool and sleeve arrangement with a mechanical null adjust. Spool position is fed back to the first stage by means of a cantilever spring. An integral 35 micron (absolute) filter reduces sensitivity to contamination of the first stage.

An SM4 servovalve, when used with a hydraulic cylinder, position transducer, and appropriate electronics, can provide infinite cylinder position control to within 0,025 mm (0.001 in) or better, depending on the components selected, length of stroke, and load characteristics.

When applied with servo hydraulic motors using tachometer feedback and appropriate electronics, the SM4 provides infinite proportional flow control for real-time velocity/acceleration profiles. The resulting closed loop system can be error corrected to within one-tenth of a revolution per minute. With appropriate pressure transducers or load cells in force control applications, the SM4 makes possible exact load pressure/force control. In addition, excellent system stability with pressure and load to  $\pm 1\%$  full scale can be achieved.

The field-proven design of the SM4-20 servovalve, combined with Vickers precision manufacturing techniques, provides you with the optimum in system control.

## Contents of catalog

Operating Data  
Performance Curves  
Model Code  
Installation Dimensions  
SM4M(E) Mounting Subplates  
SM4A Adapter Manifolds  
SM4FV Flushing Valves  
SM4FM Filter Modules  
Weights  
Additional Accessories  
Application Data



## SM4-20 (-50 Design) Servovalves

Flows to 76 l/min (20 USgpm) — Pressures to 350 bar (5000 psi)



Refer to separate catalog 662



# Introduction

Vickers SM4-20 (-50 design) servovalves can provide system closed loop control with exact positional accuracy, repeatable velocity profiles, and predictable force or torque regulation. Typical applications include automatic gage control (AGC), roll bend/roll balance systems, plastic injection molding systems, test and simulation equipment, and hydraulic press brakes.

The high performance SM4-20 (-50 design) offers a wide range of rated flows from 3.8 to 76 l/min (1.0 to 20 USgpm) at  $\Delta p$  of 70 bar (1000 psi). The -50 design valve is designed for a maximum supply pressure of 350 bar (5000 psi).

The SM4-20 (-50 design) is a two-stage, modular design, flow control valve which can be manifold or subplate mounted. The first stage consists of a symmetrical torque motor with dual coils and quad air gaps, flapper-nozzle pilot, and a centering feedback spring. An integral 35 micron absolute filter reduces sensitivity to contamination of the first stage.

The second stage utilizes a four-way sliding spool and sleeve arrangement with a mechanical null adjust. Spool position is fed back to the first stage by means of a cantilever spring.

An SM4-20 (-50 design) servovalve — when used with a hydraulic cylinder, position transducer, and appropriate electronics — can provide infinite cylinder position control to within 0.025 mm (0.001 in) or better, depending on components selected, length of stroke, and load characteristics.

When applied with servo hydraulic motors using tachometers and appropriate electronics, the SM4 provides infinite proportional flow control for realtime velocity/acceleration profiles. The resulting closed loop system can be error corrected to within one-tenth of a revolution per minute. With appropriate pressure transducers or load cells in force control applications, the SM4-20 (-50 design) makes possible exact load pressure/force control. In addition, excellent system stability with pressure and load to  $\pm 1\%$  full scale can be achieved.

The field-proven design of the SM4-20 (-50 design) servovalve, combined with Vickers precision manufacturing techniques, provides you with the optimum in system control.

## Contents of catalog

Operating Data

Performance Curves

Model Code

Installation Dimensions

SM4M(E) Mounting Subplates

SM4A Adapter Manifolds

SM4FV Flushing Valves

SM4FM Filter Modules

Weights

Additional Accessories

Application Data



## SM4-30 Servovalves

Flows to 113 l/min (30 USgpm) — Pressures to 140 bar (2000 psi)



Refer to separate catalog 653

# Introduction

Vickers SM4-30 servovalves can provide system closed loop control with exact positional accuracy, repeatable velocity profiles, and predictable force or torque regulation.

Typical applications include plastic injection molding and blow molding systems, test and simulation equipment, die casting machines, hydraulic press brakes, animation and entertainment equipment, oil exploration vehicles, and lumber machinery.

This model of the high performance SM4 series offers a wide range of rated flows from 57 to 113 l/min (15 to 30 USgpm) at  $\Delta p$  of 70 bar (1000 psi).

The SM4 is a two-stage, modular design, flow control valve which can be manifold or subplate mounted. The symmetrical, dual coil, quad air gap torque motor is integrally mounted to the first stage nozzle flapper pilot valve with two studs. An integral 35 micron absolute filter protects against contamination of the pilot stage. The second stage utilizes a four-way sliding spool and sleeve arrangement with a mechanical null adjust. Spool position is fed back to the first stage by means of a cantilever spring.

An SM4 servovalve, when used with a hydraulic cylinder, position transducer, and appropriate electronics, can provide infinite cylinder position control to within 0.025 mm (0.001 in) or better, depending on component selection, length of stroke, and load characteristics.

When applied with servo hydraulic motors, tachometers, and appropriate electronics, the SM4-30 can provide infinite proportional flow control for real-time velocity/acceleration profiles. These profiles can be closed loop error corrected to within one-tenth of a revolution per minute. When used with pressure transducers or load cells, cylinders, and appropriate electronics in force control applications, the SM4 offers exact load pressure/force control and excellent system stability with pressure and load to  $\pm 1\%$  full scale.

The field-proven design of the SM4-30 servovalves, combined with Vickers precision manufacturing techniques, provides you with the optimum in system control.

## Contents of catalog

Operating Data  
Performance Curves  
Model Code  
Installation Dimensions  
SM4M(E) Mounting Subplates  
SM4A Adapter Manifolds  
SM4FV Flushing Valves  
Weights  
Additional Accessories  
Application Data





## SM4-40 Servovalves

Flows to 151 l/min (40 USgpm) — Pressures to 350 bar (5000 psi)



Refer to separate catalog 654

# Introduction

Vickers SM4-40 servovalves can provide system closed loop control with exact positional accuracy, repeatable velocity profiles, and predictable force or torque regulation.

Typical applications include plastic injection molding and blow molding systems, test and simulation equipment, die casting machines, hydraulic press brakes, animation and entertainment equipment, oil exploration vehicles, and lumber machinery.

Applications of the 350 bar (5000 psi) SM4-40 (-50 design) include automatic gage control (AGC), roll bend/roll balance systems, plastic injection molding systems, test and simulation equipment, and hydraulic press brakes.

This model of the high performance SM4 series offers a wide range of rated flows from 76 to 151 l/min (20 to 40 USgpm) at  $\Delta p$  of 70 bar (1000 psi).

The SM4 is a two-stage, modular design, flow control valve which can be manifold or subplate mounted. The symmetrical, dual coil, quad air gap torque motor is integrally mounted to the first stage nozzle flapper pilot valve with six screws. The second stage utilizes a four-way sliding spool and sleeve arrangement with a mechanical null adjust. Spool position is fed back to the first stage by means of a cantilever spring. An integral 35 micron (absolute) filter protects against contamination of the first stage.

An SM4 servovalve, used with a hydraulic cylinder, position transducer, and appropriate electronics, can provide infinite cylinder position control to within 0,025 mm (0.001 in) or better (depending on component selection, length of stroke, and load characteristics).

When applied with servo hydraulic motors, tachometers, and appropriate electronics, the SM4 provides infinite proportional flow control for real-time velocity/acceleration profiles that can be closed loop error corrected to within one-tenth of a revolution per minute. With appropriate pressure transducers or load cells, cylinders, and proper electronics in force control applications, the SM4 offers exact load pressure/force control and excellent system stability with pressure and load to  $\pm 1\%$  full scale.

The field-proven design of the SM4-40 servovalve, combined with Vickers precision manufacturing techniques, provides you with the optimum in system control.

## Contents of catalog

Operating Data  
Performance Curves  
Model Code  
Installation Dimensions  
SM4M(E) Mounting Subplates  
SM4A Adapter Manifolds  
SM4FV Flushing Valves  
SM4FM Filter Modules  
SM4CB Cross Port Bleed  
Weights  
Additional Accessories  
Application Data



## SX4 Servovalves

Flows to 76 l/min (20 USgpm) — Pressures to 350 bar (5000 psi)



Refer to separate catalog 650



# Introduction

Vickers SX4 servovalves provide closed loop control with exact positional accuracy, repeatable velocity profiles, and predictable force or torque regulation. Compared to Vickers SM4 servovalves, the SX4 offers extended frequency response and improved stability in closed loop systems.

Typical applications include plastic injection molding and blow molding systems, test and simulation equipment, die casting machines, hydraulic press brakes, animation and entertainment equipment, oil exploration vehicles, and lumber machinery.

The four models in the extended frequency response SX4 series offer a wide range of rated flows from 3,8 to 76 l/min (1,0 to 20 USgpm) at  $\Delta p$  of 70 bar (1000 psi).

The SX4 is a two-stage, modular design, flow control valve which can be manifold or subplate mounted. The symmetrical, dual coil, quad air gap torque motor mounts to the first stage nozzle flapper valve with six screws for better stability in high shock environments. An integral 35 micron absolute filter reduces sensitivity to contamination of the first stage. The second stage utilizes a four-way sliding spool and sleeve arrangement with a mechanical null adjust. Spool position is fed back to the first stage by means of a mechanical spring.

\* — For use with SX4 or SM4 valves

An SX4 servovalve can be used with a hydraulic cylinder, position transducer, and electronics for infinite cylinder position control to within 0,025 mm (0,001 in) or better, depending on component selection, length of stroke, and load characteristics. When applied with servo hydraulic motors, tachometers, and electronics, the SX4 provides infinite proportional flow control for real-time velocity/acceleration profiles that can be closed loop error corrected to within one-tenth of a revolution per minute. With appropriate pressure transducers or load cells, cylinders, and electronics in force control applications, the SX4 offers exact load pressure/force control and excellent system stability with pressure to  $\pm 0,07$  bar ( $\pm 1$  psi) and load to  $\pm 1\%$  full scale.

The field-proven design of the SX4 servovalve, combined with Vickers precision manufacturing techniques, provides you with the optimum in system control.

## Contents of catalog

Operating Data

Performance Curves

Model Code

Installation Dimensions

SM4M(E) Mounting Subplates\*

SM4A Adapter Manifolds\*

SM4FV Flushing Valves\*

SM4FM Filter Module\*

Weights

Additional Accessories

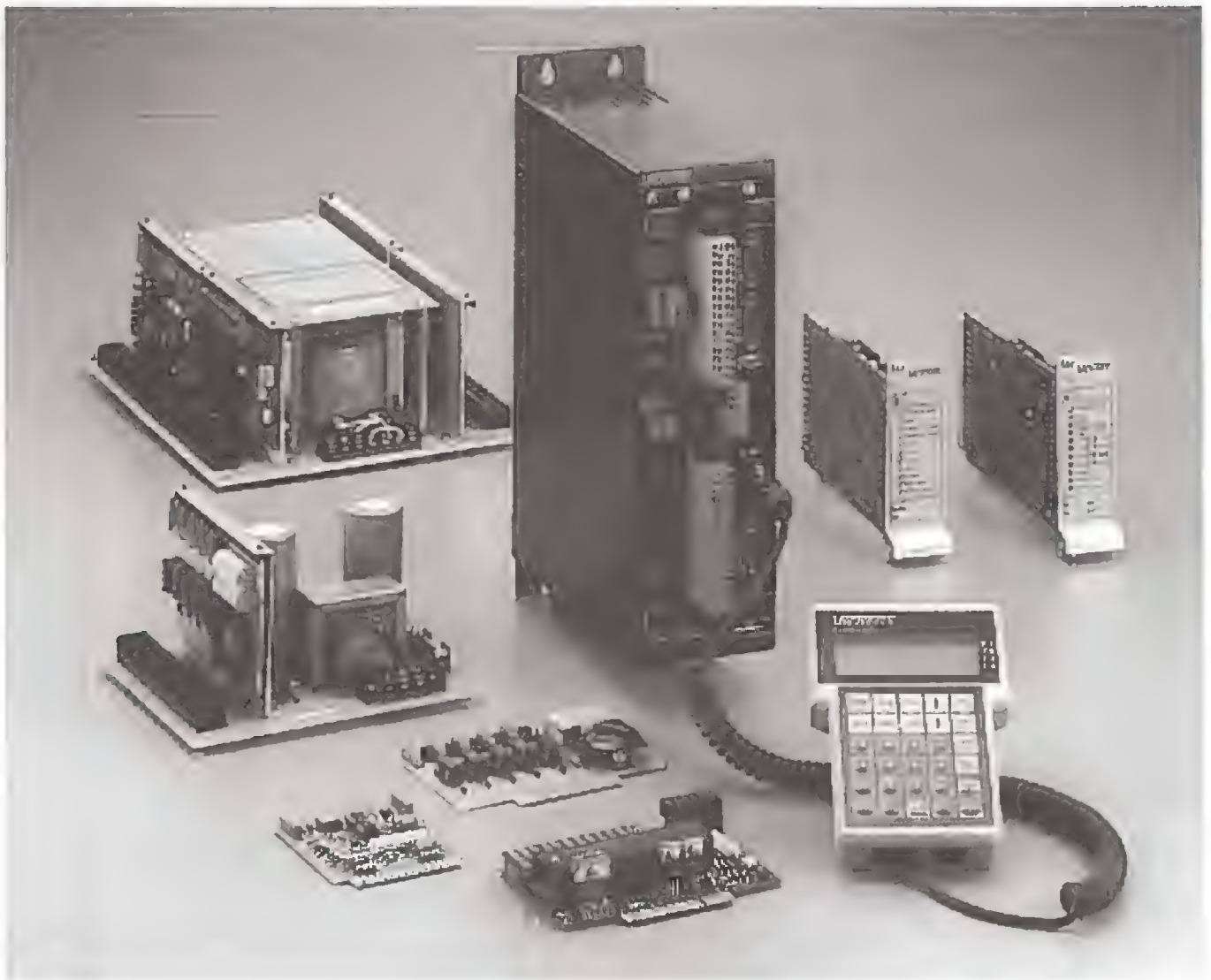
Application Data

\* For use with SX4 or SM4 valves



# Servo Electronics

Amplifiers, Power Supplies, Function Modules, and Controllers



Refer to separate catalog 656

# Introduction

Vickers amplifiers, power supplies, and function modules provide a convenient and economical package of electronics for closed loop servo control.

These electronic components have been specially designed and assembled for high reliability and improved ease of use. They can be applied in systems utilizing Vickers servovalves and proportional valves and may also be used to control competitors' valves.

EM series power supplies and the SMC 20H controller are panel mounted. EM series amplifiers and function modules plug into fully compatible slots in the EMRS-A-11 and EMP-A-20 power supply units. The EEA series amplifiers are designed for use in a standard rack mount.

For accurate and repeatable system performance with assured component compatibility, trust Vickers servo electronics.

## Contents of catalog

EM-D-30 Servo Amplifier with PID

EM-K-10 Ramp Module

EM-J-10 Programmer Module

EMRS-A-11 Power Supply Unit

EMP-A-20 Power Supply Unit

EEA-PAM-591 Amplifiers

EEA Accessory Products

SMC 20H Two-Axis Hydraulic Position Controller

## SM4 and SX4 Servovalves Installation and Troubleshooting Guide



### Introduction

The Vickers SM4 series and SX4 extended frequency response series valves are precision, closed-center, four-way sliding spool servovalves. System performance is enhanced when the Vickers servovalve is applied as part of the control solution. Exact positional accuracy, repeatable velocity profiles, as well as predictable force and torque regulation are realized when including the Vickers servovalve as part of the system control.

Before installing the valve, check that the model designation on the nameplate is correct for the application.

#### NOTE

The operation and performance of each servovalve is factory-tested by Vickers before release for shipment. Warranty on these products may be disallowed by such actions as:

- unauthorized field disassembly of the valve
- incorrect installation
- application of the valve outside of performance or environmental limits
- incorrect electrical connection or control signals

### Valve Installation

The steps below must be followed when installing a servovalve.

1. Do not remove the shipping plate from the valve until immediately prior to installation.
2. Be careful not to lose the O-rings from the valve ports.
3. Be sure the O-rings and both mounting pads are clean, undamaged, and free from burrs.
4. Carefully place the valve on the manifold pad.

#### NOTE

Most servovalves have a locating pin to ensure correct port orientation. Make sure this pin lines up with the mating hole in the manifold pad. If there is no locating pin, make sure the valve P port is lined up with the pressure port on the manifold pad and that the remaining ports are properly aligned.

5. Secure the valve to the manifold with the appropriate bolts torqued to the proper tightness per the following table:

Valve Model	Bolt Size	Torque*
SM4-10/12/15 and SX4-10/12/15	1/4-20 x 2 1/4" (inch) or M6 x 60mm (metric)	7,5 to 9,5 Nm (108 to 132 lb.in.)
SM4-20 and SX4-20	5/16-18 x 2" (inch) or M8 x 50mm (metric)	18,6 to 22,6 Nm (216 to 264 lb.in.)
SM4-30	1/4-20 x 1 1/4" (inch) or M6 x 35mm (metric)	7,5 to 9,5 Nm (108 to 132 lb.in.)
SM4-40	5/16-18 x 3" (inch) or M8 x 80mm (metric)	18,6 to 22,6 Nm (216 to 264 lb.in.)

\* - Torque values are for lubricated threads using Grade 8,8 (metric) or Grade 8 (inch) mounting bolts.



# Electrical Installation

Following the diagram below, wire the female electrical connector (Amphenol No. MS3016A-14S-2S) as required by the system application.

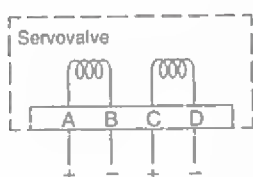
Check the valve model number on the name plate. The single coil resistance (in ohms) and rated maximum current (in milliamps) are part of the valve model code as shown in the following example.

**SM4-20(5)19-80/40-10**

Single coil resistance =  $80\Omega$       Maximum rated current = 40 mA

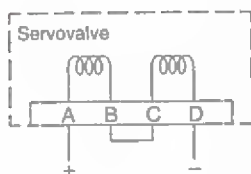
## Single:

A+, B-  
or  
C+, D-



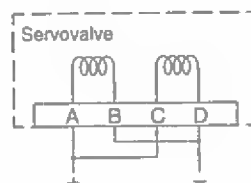
## Series:

A+, D-  
Connect B and C



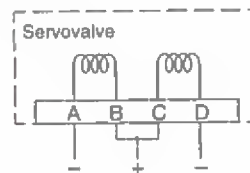
## Parallel:

A+, C+  
B-, D-  
Connect A and C  
Connect B and D



## Differential:

A-, D-  
B+, C+  
Connect B and C  
BC-, current BA > CD  
BC+, current CD > BA



# Mechanical Null Adjust

All SM4 and SX4 servovalves have a mechanical null adjustment. All valves are shipped with the null adjust set at the center position. In the center position, the A and B control port pressures are equal when no electrical signal is being applied to a blocked port valve.

Occasionally, the servovalve may require a mechanical adjustment to ensure the spool is located at a centered or null position. Normally this adjustment is needed when either

- a) the actuator experiences significant flow movement at zero input signal/no load conditions, or
- b) a different maximum flow output from each cylinder port is noted for equal input signals in both directions.

## Null Adjustment Procedure

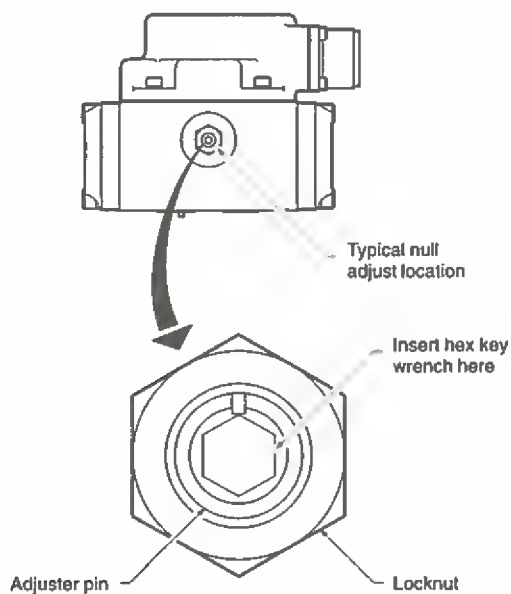
1. Turn off the machine.
2. Vent pressure to the valve and actuator.
3. Make sure the actuator is free to move throughout its range of travel without damage to tooling, fixtures, etc.
4. Disconnect the electrical connector from the valve. This causes the valve command signal to be zero.

# Mechanical Null Adjust

## NOTE

Do not loosen the locknut. It is tightened at the factory so that 1,6 to 2,0 Nm (14 to 18 lb.in.) of torque are needed to turn the adjuster pin.

5. For all valves except the SM4-40, insert a 2,38mm ( $3/32$  inch) hex key wrench into the adjuster pin. For an SM4-40 valve, insert a 2,82mm ( $7/64$  inch) hex key wrench into the adjuster pin.



6. While watching the actuator, start up the system and slowly increase system pressure to its normal operating level. There should be little or no actuator movement.

## CAUTION

For all valves except the SM4-40, turning the adjuster pin clockwise increases flow from port A. For the SM4-40, turning the adjuster pin clockwise increases flow from port B.

7. If there was significant actuator movement in step 6, slowly adjust the valve using the hex key wrench until there is little or no actuator movement.
8. Turn off the machine.
9. Vent pressure to the valve and actuator.
10. Connect the electrical connector to the valve.
11. Restart the system according to the system designer's recommendations and procedures.

# Troubleshooting

The following support equipment recommendations and flow chart are to be used as an aid in troubleshooting servocontrol system faults.

A good proactive maintenance program will ensure minimum unscheduled downtime. Fluid cleanliness, periodic maintenance on mechanical parts, and operating within recommended parameters help to maximize system reliability.

## Minimum Recommended Support Equipment

As a minimum, the following items should be available for system startup and any troubleshooting.

- 1 – High pressure gage, 0 to 350 bar (0 to 5000 psi)
- 2 – Pressure gages, 0 to 210 bar (0 to 3000 psi)
- 1 – Low pressure gage, 0 to 70 bar (0 to 1000 psi)
- 1 – Digital multimeter suitable for reading voltage, current, and frequency (Fluke Model 87 or equivalent)
- Miscellaneous – Small tools for removing and installing the valve and performing null adjustment procedures.

## Optional Support Equipment

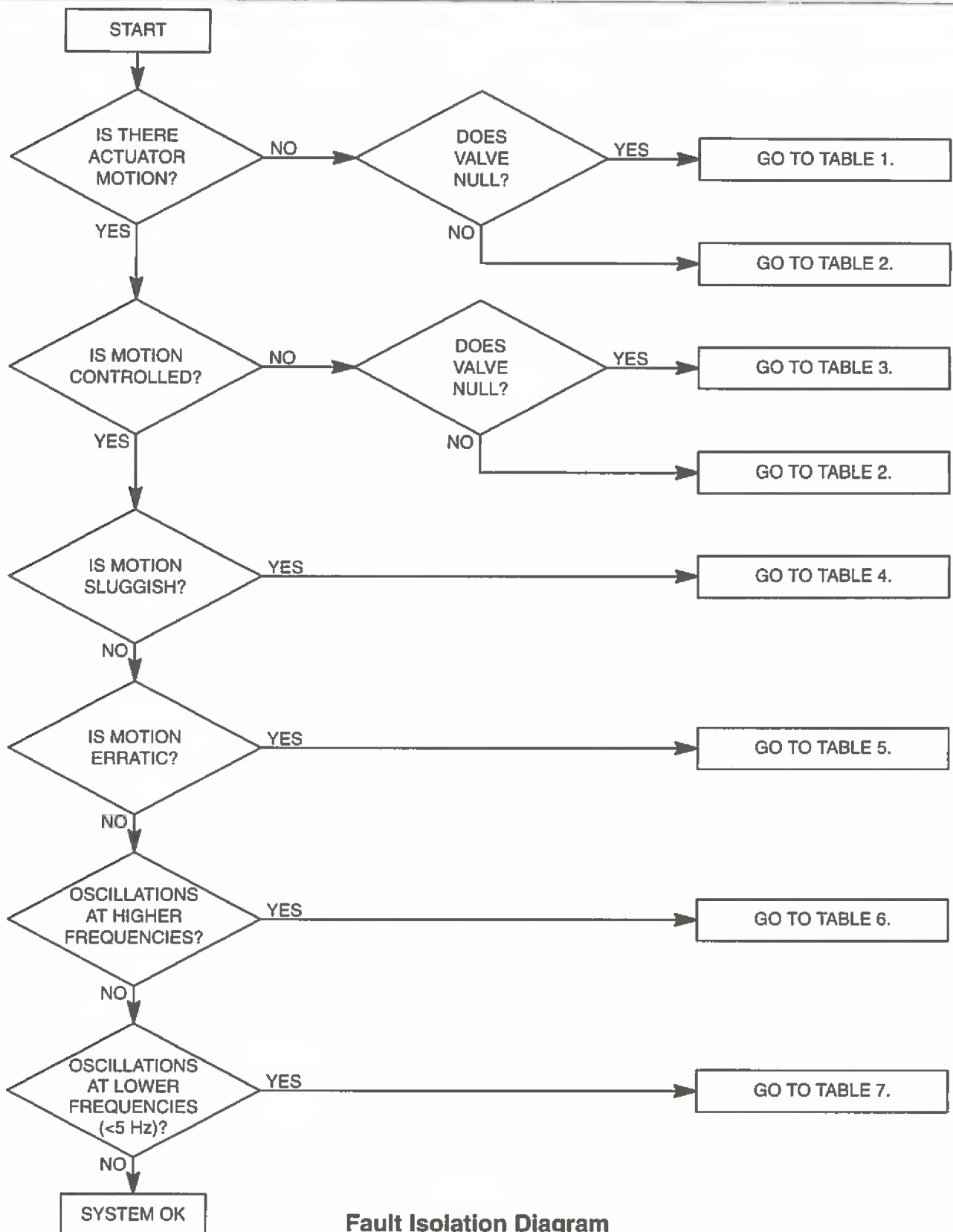
- As required – Pressure transducers capable of measuring transient events at up to proof pressures (ideally one transducer per valve port)
- 1 – Four to six channel portable recorder, DC operated, capable of recording transient events as captured by the pressure transducer(s)

## System Fault Isolation

The diagram and tables on the following pages will aid in system troubleshooting by helping to isolate faults due to the servovalve.

Because systems can vary significantly in type and complexity, these troubleshooting and repair recommendations are not intended to be all inclusive.

# Troubleshooting



Fault Isolation Diagram

## Corrective Action Tables

**Table 1**

Check these items (in sequence):	If item is bad:
Valve coil resistance	Replace valve.
Command signal to valve	Check electronics and cabling. Repair or replace if bad.
Pump flow	Adjust, repair, or replace.
System pressure	
Filters for blockage	Sample for fluid contamination. Replace filters.*

\* If system fluid is contaminated, servovalve may require cleaning and recalibration.

**Table 2**

Check these items (in sequence):	If item is bad:
Valve installation	
Supply pressure	
System plumbing for crossed lines	Adjust, repair, or replace.
Machine mechanical components for binding	
Actuator seals and packings for extreme contamination	
All items above OK	Replace valve.

**Table 3**

Check these items (in sequence):	If item is bad:
Feedback signal	Repair.
Feedback polarity	Change polarity.
Valve coil wiring for crossed wires	Repair.
Command signal to valve	Check electronics and cabling. Repair or replace if bad.

**Table 4**

Check these items (in sequence):	If item is bad:
Command signal to valve	Check electronics and cabling. Repair or replace if bad.
Filters for blockage	Sample for fluid contamination. Replace filters.*
Machine mechanical components for binding	
Pump flow	Adjust, repair, or replace.
System pressure	
Electronics for excessively low gain	Adjust.
All items above OK	Replace valve.

\* If system fluid is contaminated, servovalve may require cleaning and recalibration.



**Table 5**

<b>Check these items (In sequence):</b>	<b>If item is bad:</b>
Hydraulic fluid for cleanliness	Clean fluid. Replace filters.*
System wiring for opens or shorts	
Feedback device for excessive wear or intermittent faults	Repair or replace.
Electronics for intermittent faults	
Machine mechanical components for binding or backlash	Adjust, repair, or replace.

\* If system fluid is contaminated, servovalve may require cleaning and recalibration.

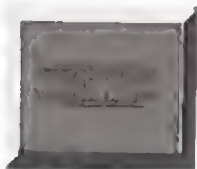
**Table 6**

<b>Check these items (In sequence):</b>	<b>If item is bad:</b>
Electronics for dither (if dither required by system)	Adjust, repair, or replace.
Electronics for excessively high gain	Adjust.
Command signal to valve for excessive noise	Check electronics. Repair or replace if bad.
Feedback signal for excessive noise	Check feedback electronics, cabling, and transducer. Repair or replace if bad.

**Table 7**

<b>Check these items (In sequence):</b>	<b>If item is bad:</b>
Electronics for dither (if dither required by system)	Adjust, repair, or replace.
Electronics for excessively low gain	Adjust (loop gain ratio).
Machine mechanical and feedback components for wear	Repair, or replace.





## Electrohydraulic Controls: Proportional Valves – Section B

	Catalog Number	Page Number
<b>Proportional Valves</b>		
EMA Amplifier for EMV-611e	Refer to separate catalog 5024/EN/0496/A	B.1
EHST-3, 30 Design	689	B.3
K(A)CG-3, 10 Design	GB 2162E	B.189
K(A)CG-6/8, 10 Design	GB 2324D	B.200
K(A)DG5V-5/7/8, 1*/3* Design / K(A)FDG5V-5/7/8, 22 Design / K(A)HDG5V-5/7/8, 2* Design	GB 2457A	B.173
K(A)DG5V-5/7/8, 10 Design & KDG5V-10, 10 Design	5052 EN 1097 A	B.129
K(A)DG4V-5, 30 Design & K(A)TG4V-5, 30 Design	GB 2452	B.40
K(A)X(C)G-6/8, 10 Design	GB 2322D	B.214
K(B)FD/TG4V-3, 1*/2* Design	5071.00/EN/0497/A	B.54
K(B)FD/TG4V-5, 1*/2* Design	5071.01/EN/0797/A	B.70
KBHDG5V-5/7, 10 Design	5071.04/EN/1197/A	B.113
K(B)SDG4V-3, 1* Design	5071.02/EN/0797/A	B.89
KBSDG4V-5, 1* Design	5071.03/EN/0997/A	B.101
KDG4V-3(S) & KTG4V-3(S)	539	B.11
KDG3V-5/7/8, 10 Design	GB 2405	B.168





## EMV-611e Electro-Hydraulic Mobile Control Valve

Flows to 160 l/min (42 USgpm) System Pressures to 320 bar (4600 psi)

### EMA (Amplifier for EMV-611e)

Digital Electronics



*This product has been designed and tested to meet specific standards outlined in the European Electromagnetic Compatibility Directive (EMC) 89/336/EEC, amended by 91/263/EEC and 92/31/EEC. For instructions on installation requirements to achieve effective protection levels, see this leaflet and the Installation Wiring Practices for Vickers Electronic Products leaflet 2468. Wiring practices relative to this Directive are indicated by  Electro Magnetic Compatibility (EMC)*

Refer to separate catalog 5024/EN0496/A



# Introduction

The EMV-611e is a sectional design electro-hydraulic mobile control valve with screw-in, pretested, preset individual control elements, allowing maximum flexibility in tailoring the valve to meet the needs of your specific application.

The EMV-611e allows for maximum machine productivity and high performance with rated flows to 160 l/min (42 US gpm) at 14 bar  $\Delta P$  and pump pressures to 320 bar (4600 psi).

Designers have the opportunity to select fully flexible, optimum performance solutions for all machine types.

To compliment the EMV-611e, Vickers offers our own driver – the EMA Amplifier.

The EMA simplifies communications by interfacing directly with the EMV. The EMA can be driven directly from an Electronic Remote Control (ERC), PC or a Central Processing Unit (CPU).

The EMA is environmentally friendly and is built to withstand submersion in water and abuse or shock. It can withstand erroneous electronic signals in line with European legislation.

All backed by Vickers experience as the market leader in mobile controls.

## Contents of catalog

### **EMV-611e Electro-Hydraulic Mobile Control Valve**

Features and Benefits

Model Description/Operating Data

Valve Sections/Model Codes

Flow Curves

Flow Curves/Functional Symbols

Installation Dimensions

### **EMA (Amplifier for EMV-611e)**

Features and Benefits/Model Code

General Description

Operating Data . .

Additional Data . .

Installation Dimensions

Application Data



# Proportional Pressure Control with Integrated Electronics

**EHST-3-30 Series**



# General Information

## Mounting Interface

ISO 4401 size 3  
ANSI/B93.7M size D03

## Basic Characteristics

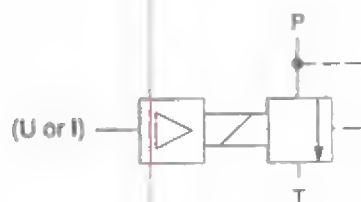
Maximum pressure 90 or 210 bar  
(1305 or 3045 psi)  
depending on model  
Maximum flow rate 2.5 l/min  
(0.65 US gpm)  
Optimum performance flow 1 l/min  
(.26 USgpm)  
Hysteresis  $\leq 2.4\%$   
(Between 5 and 100% of rated output)  
Linearity  $\leq 1\%$  of max. signal  
Command signal 0-10 volts or 4-20mA  
depending on model

## Description

A high performance electro-hydraulic proportional relief valve with integral electronics amplifier, utilizing surface mount technology. Exceptional performance is obtained from the combination of a "frictionless" mechanical design and the use of linearization electronic circuitry.

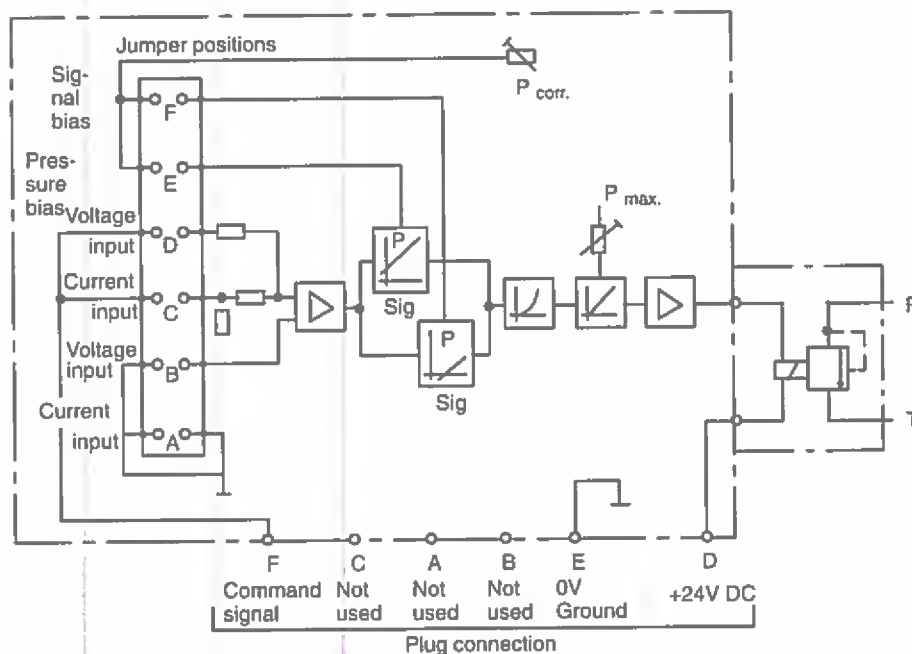
The valve is ideal for use as a pilot stage for larger valves and for control of variable displacement pumps and motors. It is particularly suited to applications using programmable logic controllers or microprocessors.

## Functional Symbols

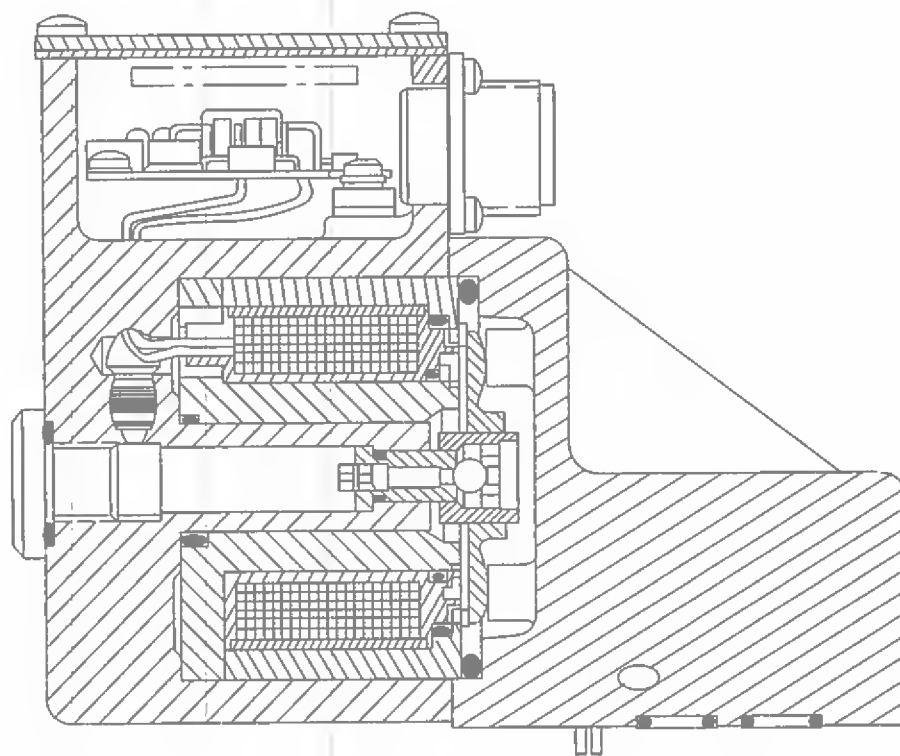


Simplified symbol

Symbol with basic electronic circuitry and connections

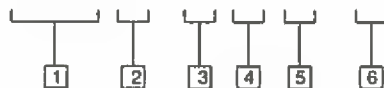


## Construction of EHST-3 valve



# Model Code

**EHST-3-- \* \* \* -30**



## 1 Proportional Pressure Control with Integrated Electronics

## 2 Mounting Interface

3 – ISO 4401 Size 3, ANSI/B93.7M size D03

## 3 Pressure range

(At nominal flow rating; 1 l/min [0.26 US gpm])

B – 4-90 bar (58-1305 psi)

F – 5,5-210 bar (78-3045 psi)

## 4 Command (Input) signal

I – +4 to 20 mA, DC

V – 0 to +10V, DC

## 5 Output bias

E – Pressure bias

F – Signal bias

## 6 Design number, 30 series

Subject to change; installation dimensions unaltered for design numbers 30 to 39 inclusive.

## Applications

The EHST is a remote control pilot for pressure relief and pressure reducing valves as well as variable displacement pumps.

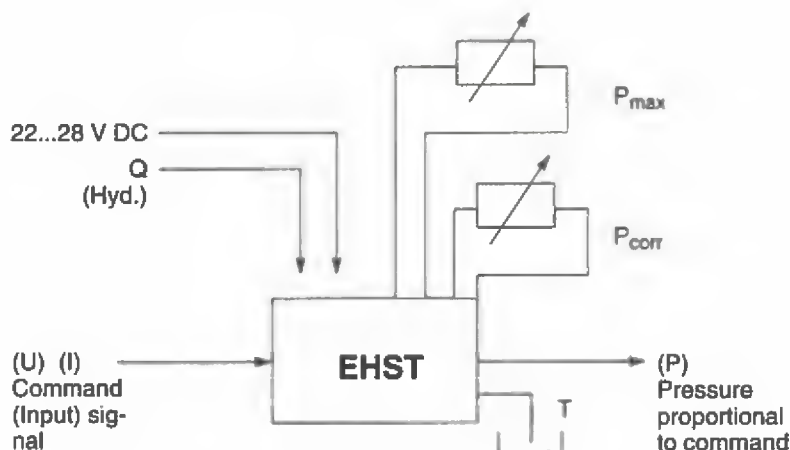
## Operation Mode

The EHST-3 design uses a floating plate armature. At the center is a ball which aligns with the nozzle of the valve. This plate armature is pulled towards an energized solenoid, thereby applying a load onto the nozzle, with a force creating a "P" port pressure proportional to the command signal.

The lack of springs, bearings, etc. makes this design essentially free of mechanical friction.

The fundamental parabolic pressure characteristics are corrected, resulting in a linear pressure output in the EHST. This is accomplished by means of a compensating network included in the valve's integrated electrical control board.

## Functional Diagram



# Operating Data

Maximum pressures: Port P Port T	90 bar (1305 psi) or 210 bar (3045 psi) depending on model 20 bar (290 psi) NOTE: Pressure in port T is <i>additive</i> to the controlled pressure and significantly affects minimum pressure capability of the valve. For optimum performance and to avoid high cyclic system pressure peaks, connect port T directly to tank.								
Minimum pressure @ 1 l/min. 210 bar (3045 psi) F model 90 bar (1300 psi) B models	5.5 bar (80psi) 4.0 bar (60 bar)								
Flow rates: Rated flow (Optimum valve performance) Maximum flow	1 l/min (0.26 US gpm) 2,5 l/min (0.65 US gpm)								
Electrical power requirements: Supply voltage  Command signal	+22-28V DC at 1,2A Max. ripple 10% peak to peak 0-10V DC (nominal impedance 32 kΩ) or 4-20 mA (nominal impedance 200Ω) (depending on model)								
Protection classifications: Coil winding Valve fitted with MS3102E-14S-6P receptacle Mating 3 plug	Class F insulation IEC 144 Class IP65 MS3106A-14S-6P								
Relative duty factor	100% (continuously rated)								
Operating temperatures: Ambient Fluid	-20°C to 50°C (-4°F to 122°F) 80°C (176°F) maximum								
Hydraulic fluids	These valves are fitted with standard (nitrile rubber) seals are suitable for use with anti-wear hydraulic oils. Optimum valve performance is obtained using fluids in the viscosity range 54 to 13 cSt (245 to 70 SUS). The extreme operating viscosity range is 500 to 13 cSt (2200 to 70 SUS).								
Filtration	<i>System Pressure psi (bar)</i> <table><tr><td>&lt;70 (&lt;2000 )</td><td>70-210 (2000-3045)</td><td>207+ (3045+)</td></tr><tr><td>17/15/12</td><td>17/15/12</td><td>15/13/11</td></tr></table>			<70 (<2000 )	70-210 (2000-3045)	207+ (3045+)	17/15/12	17/15/12	15/13/11
<70 (<2000 )	70-210 (2000-3045)	207+ (3045+)							
17/15/12	17/15/12	15/13/11							
Installation data: Mounting attitude	No restrictions.								

## Fluid Cleanliness

Proper fluid condition is essential for long and satisfactory life of hydraulic components and systems. Hydraulic fluid must have the correct balance of cleanliness, materials and additives for protection against wear of components, elevated viscosity and inclusion of air.

Essential information on the correct methods for treating hydraulic fluid is included in Vickers publication 561, "Vickers Guide to Systemic Contamination Control," available from your local Vickers distributor or by contacting Vickers, Incorporated. Recommendations on filtration and the

selection of products to control fluid condition are included in 561.

Vickers products, as any components, will operate with apparent satisfaction in fluids with higher cleanliness codes than those described. Other manufacturers will often recommend levels above those specified.

Experience has shown, however, that life of any hydraulic components is shortened in fluids with higher cleanliness codes than those listed below. These codes have been proven to provide a long trouble-free service life

for the products shown, regardless of the manufacturer.

Fire resistant fluids usually have higher specific gravities than oil. The specific gravity of a fluid may be obtained from its producer.

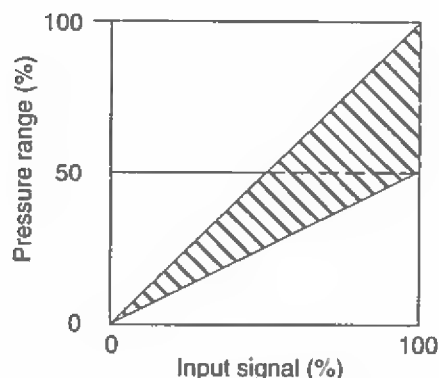
Recommended cleanliness levels, using petroleum oil under common conditions, are based on the highest fluid pressure levels in the system and are coded in the chart below. Fluids other than petroleum, severe service cycles or temperature extremes are cause for adjustment of these cleanliness codes.



# Performance Characteristics

## Maximum pressure envelope

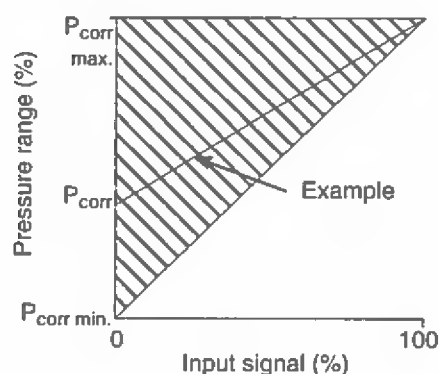
Set by on-board potentiometer "P<sub>max</sub>"



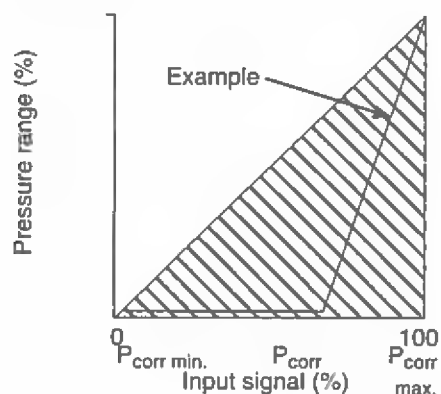
## Bias setting

Relative to max. pressure, and set by on-board potentiometer "P<sub>corr</sub>"

Pressure bias, EHST-3-\*\*E



Signal bias, EHST-3-\*\*E



Hysteresis ..... ≤2.4%

Linearity ..... ≤1% of max. signal

## Pressure over-ride: bar (psi)

Valve type	Set pressure	Pressure over-ride	
		at 1 l/min (0.26 US gpm)	at 2 l/min (0.52 US gpm)
-B**-	90 (1305)	1 (14.5)	2,7 (39)
	60 (870)	0,7 (10)	2 (29)
	30 (435)	0	0,2 (2.9)
-F**-	210 (3045)	10 (145)	20 (290)
	180 (2610)	9 (130)	19 (275)
	120 (1740)	8 (116)	18 (261)
	60 (870)	6 (87)	18 (261)

## Temperature drift: bar (psi)

Valve type	Set pressure @ 30°C (86°F)	Drift coefficient ▲		Reduction from set pressure @ 70°C (158°F)
		bar/°C	psi/°F	
-B**-	90 (1305)	0,066	(0.53)	2,64 (38)
	60 (870)	0,046	(0.37)	1,86 (27)
	30 (435)	0,016	(0.13)	0,66 (10)
-F**-	210 (3045)	0,131	(1.1)	5,24 (76)
	120 (174)	0,075	(0.6)	3 (44)
	60 (870)	0,037	(0.23)	1,48 (22)

▲ Pressure reduces as temperature increases;  
pressure increases as temperature reduces.

## Dynamic performance

Frequency response at conditions of:

Trapped volume ..... 10 ml (0.6 in<sup>3</sup>)

Operating point ..... 50% max. signal

Amplitude ..... ± 10% max. signal

Input signal form ..... sinusoidal

Flow rate ..... 1 l/min (0.26 US gpm)

Valve type	Frequency at -3 dB	Frequency at 90° phase lag
-B**-	190 Hz	120 Hz
-F**-	120 Hz	70 Hz

## Mass, approx.

2,6 kg (4.8 lb.)

## Mounting bolts and subplates

Metric bolts/G(BSPF) ports:

Bolt kit ..... BK 991917

Rear entry subplate ..... DGVM-3-10-R

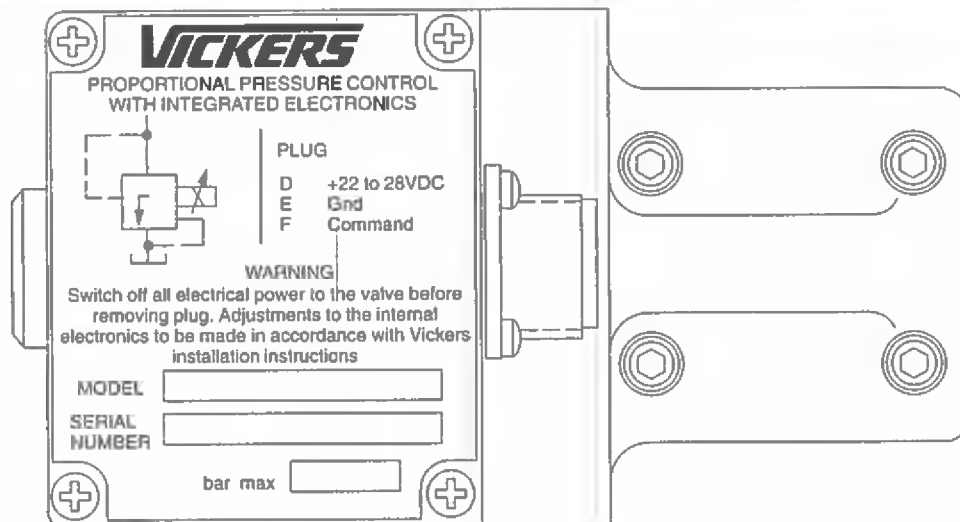
Side entry subplate .. DGVS-3-1E-10-R

Inch (UNC) bolts/SAE ports:

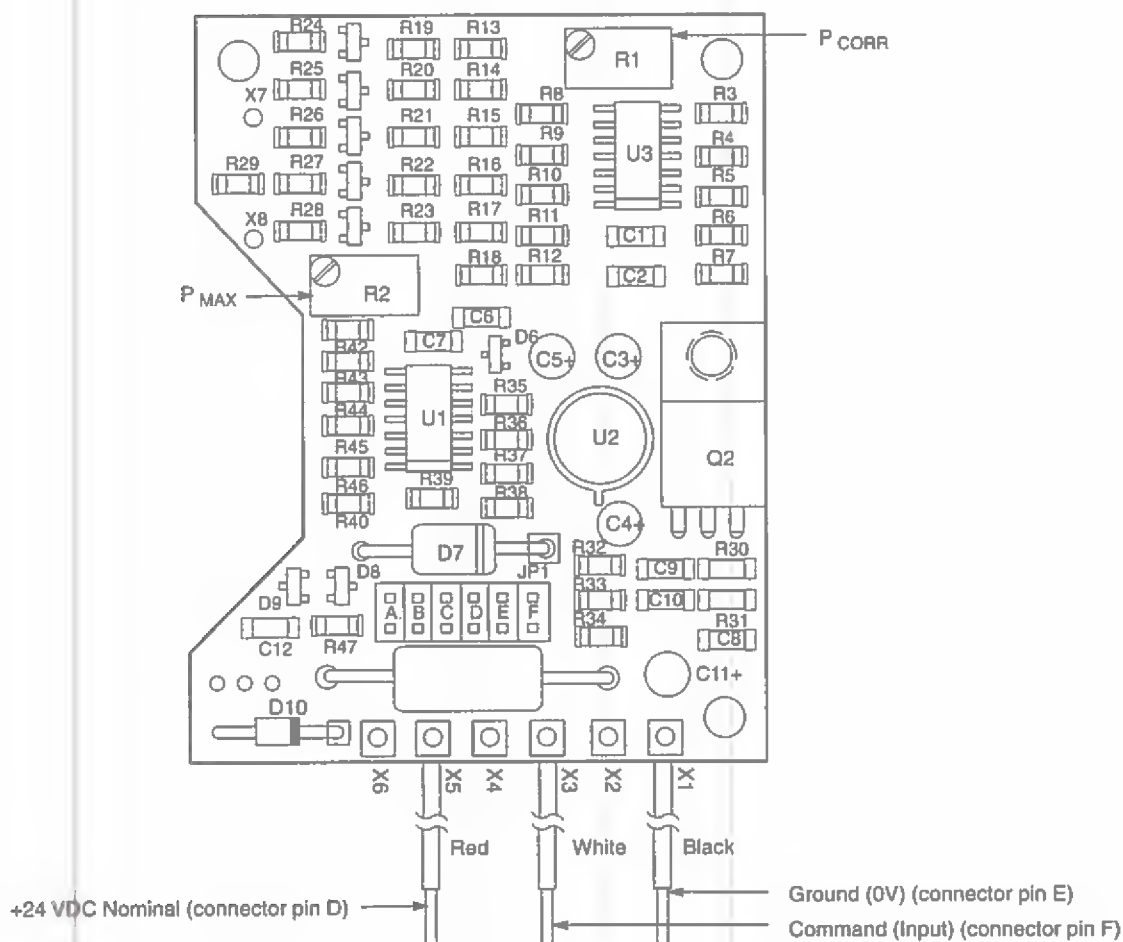
Bolt kit ..... BKMOD 617

Rear entry subplate ..... DGVM-3-10-S

Side entry subplate .. DGMS-3-1E-10-S



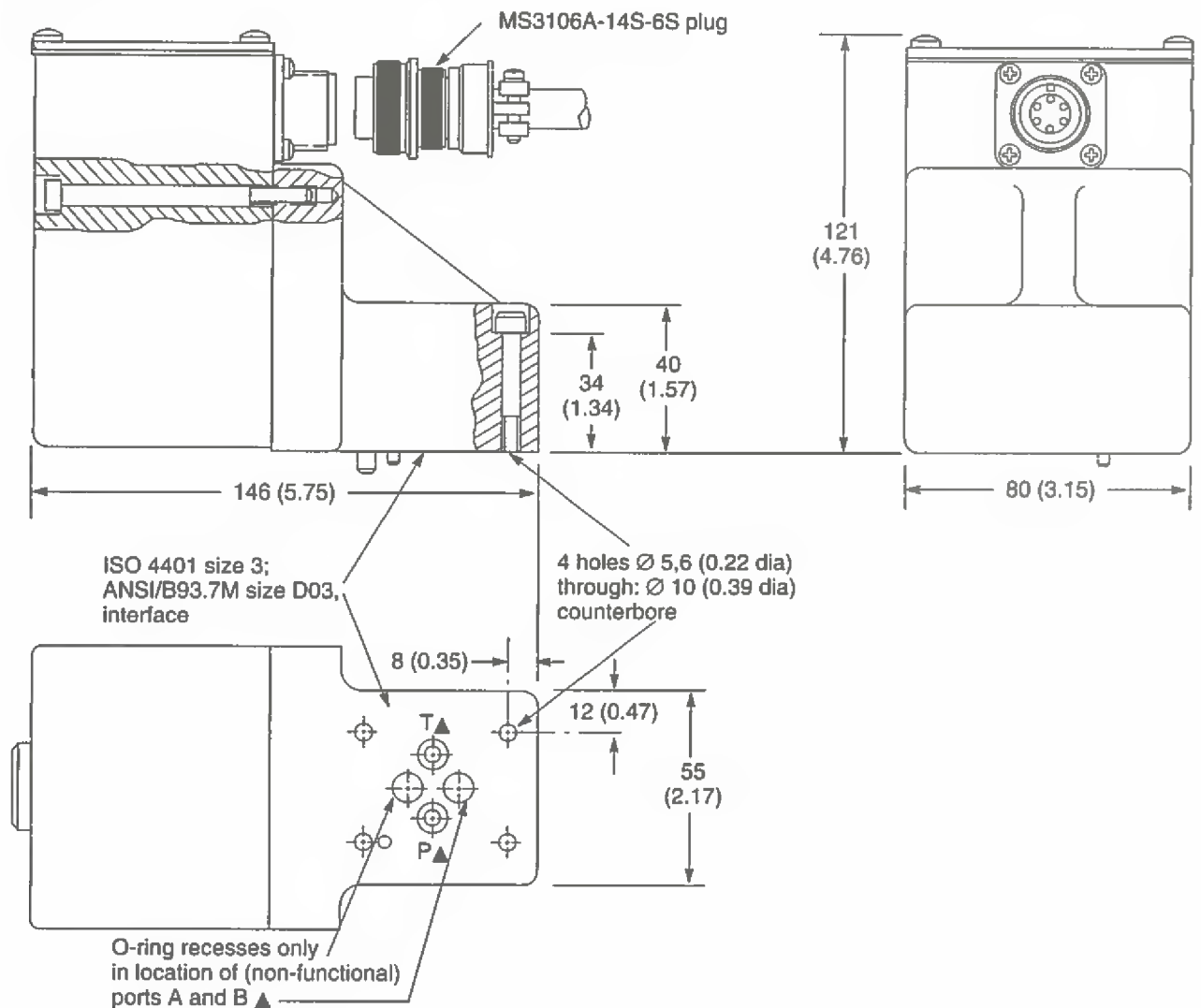
Nameplate



Location of Potentiometers

# Installation Dimensions

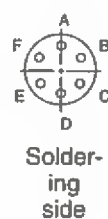
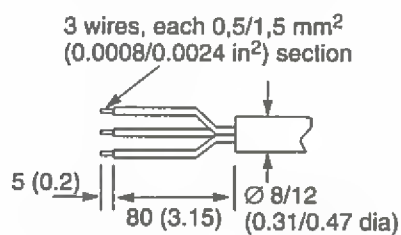
mm (inches)



▲ O-rings (4 req'd) supplied with valve

## External wiring to electrical plug

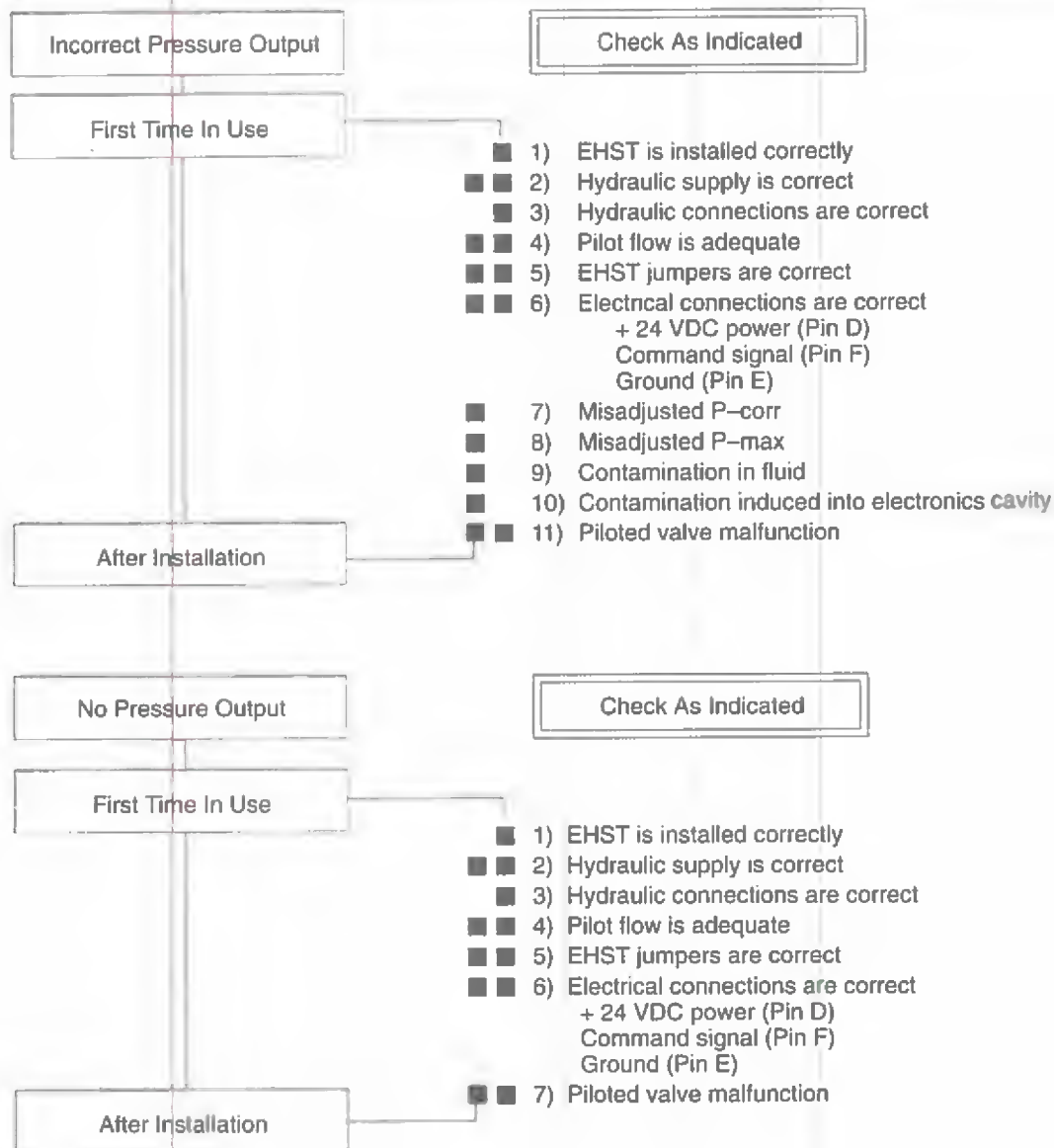
MS3106A-14S-6S Plug connection



### Electrical plug pins

- A - not used
- B - not used
- C - not used
- D - 22 to 28 VDC, main power supply input
- E - 0V (Ground)
- F - Command (input)  
0 to +10 VDC (EHST-3-\*V\*-30 models)  
+4 to 20 mA (EHST-3-\*I\*-30 models)

# Troubleshooting

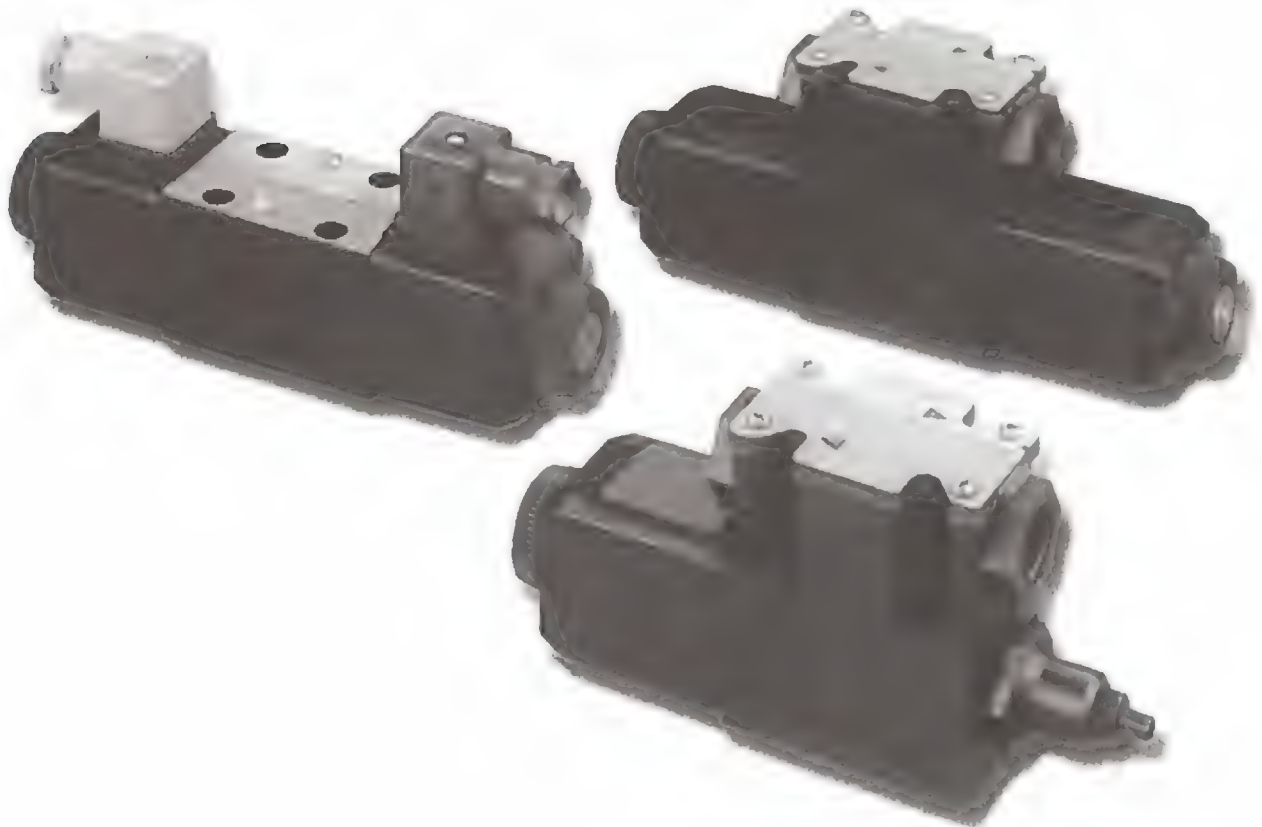


## Proportional Directional and Throttle Valves – Solenoid Operated

KDG4V-3S and KTG4V-3S standard performance series

KDG4V-3 and KTG4V-3 high performance series

ISO 4401-03 (NFPA D03) – Pressures to 350 bar (5075 psi)





# Introduction

Vickers KDG4V and KTG4V valves are non-feedback type proportional valves.

The KDG4V is a proportional directional valve with two solenoids (C models). It incorporates control of flow, direction, acceleration, and deceleration in a single control valve.

The KTG4V is a proportional throttle valve with a single solenoid. B models are spring centered with solenoid A removed. F models are spring offset to port A and respond to an increasing signal by reducing the flow rate. The KTG4V's spool can be infinitely positioned to achieve throttling (restriction) of the fluid flow.

The primary function of these valves is to direct and meter fluid flow in proportion to current received by the solenoid. This fluid flow controls the

velocity, direction, and acceleration or deceleration of a work cylinder or fluid motor.

These valves are designed to fill the performance gap between conventional solenoid operated directional valves and servo valves or feedback-type proportional valves. They provide control of spool position and metered fluid flow in applications that don't require the high levels of accuracy, repeatability, or response possible with feedback-type proportional valves or servos.

Used with Vickers electronic amplifiers, these valves provide an interface between control system intelligence and hydraulic muscle. This is a very practical way to control actuator direction and speed while eliminating shock caused by rapid acceleration and deceleration of machine loads.

In addition to improving machine performance and life, these proportional valves substantially simplify system design by combining direction and flow control capabilities in one package that mounts to a standard NFPA/ISO subplate or manifold interface.

The valve can also be readily tailored to a vast array of applications by specifying the specific valve configuration which best meets system requirements.

The valve is controlled by applying current to either solenoid A or solenoid B. This current produces a force at the solenoid push pin which, in turn, causes spool travel. The spool will continue its motion until the solenoid force is balanced by the return spring force. Therefore, spool travel is proportional to the amount of current passing through the solenoid coil.

## Features and Benefits

- These global products, manufactured to world-class quality standards, are sold and serviced throughout the world.
- The KDG4V and KTG4V have a low installed cost due to commonality of parts with Vickers DG4V-3(S) solenoid operated directional valve.
- These valves open up expanded application opportunities as a cost-effective alternative to feedback-type proportional and servo valves.
- Sustained high machine productivity and uptime result from the proven fatigue life and endurance of the reliable KDG4V and KTG4V.
- Vickers flexible design approach provides optimum performance. A wide variety of matching electronic amplifiers, valve options, and spool ratings allows the system designer flexibility in meeting application requirements.
- All valves are NFPA fatigue rated at 350 bar (5075 psi) for improved reliability and performance.
- The fully encapsulated solenoid coils are impervious to common industrial fluids. Coils can be removed and replaced quickly and easily without breaking into the hydraulic envelope.
- The valves' standard ISO 4401-03 mounting is interchangeable with any NFPA D03 or CETOP 3 interface.
- The engineering resin junction box is NEMA 4 rated for resistance to water and all commonly used industrial fluids.
- The use of Viton® O-rings throughout provides multi-fluid capability and prevents outside fluids from contacting internal valve parts.

\* Viton is a registered trademark of the DuPont Co.

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# General Information

## Typical Applications

This type of valve is often used in both mobile and industrial "line-of-sight" applications where speed and position are controlled by an operator. Some examples are aerial work platforms, entertainment industry rides, farm combine controls, material handling equipment, and process controls. Any application using a DG4V-3(S) 60-design solenoid operated directional valve is a potential application for the KDG4V-3(S) or KTG4V-3(S).

The standard performance KDG4V-3S or KTG4V-3S should be used on most applications where a tank line pressure rating of 100 bar (1450 psi) is acceptable. The high performance KDG4V-3 or KTG4V-3 should be used on applications where a tank line pressure rating of 210 bar (3000 psi) is required.

Commonly used electrical input devices include joystick controllers, proportional push buttons, potentiometers, power plugs, and amplifier cards. Input devices that operate on the principle of direct voltage rather than current control will require the appropriate coil type (GP or HA).

## Meter-in and Meter-out

System requirements must be clearly understood and taken into consideration when selecting a valve spool. Meter-out spools have the metering notches positioned between the actuator port and the tank port, creating a throttle in the hydraulic actuator's return line. Meter-out is the most common spool configuration and is typically used in applications with over center loads and/or requiring deceleration control.

Meter-in spools have the metering notches positioned between the pressure port and the actuator port, creating a throttle in the hydraulic actuator's inlet line. Meter-in spools are commonly used with hydrostat modules for pressure compensation in applications that don't have an

overrunning load as well as in load sensing pump circuits.

Spools with both meter-in and meter-out flow characteristics should be specified in applications where load changes (resistive to overrunning or vice versa) will occur. They should also be selected when uncertain system dynamics prevent the selection of specific meter-in or meter-out spool types.

## Valve Spool Position

Spring centered and spring offset valves will be spring positioned unless the solenoid is energized continuously.

### NOTE

Due to silting, any sliding spool valve held shifted under pressure for long periods may stick and not spring return. It is recommended that such valves be cycled periodically to prevent this from occurring.

## Flow Rates

The rate of flow through a proportional valve is dependent on spool position and valve pressure differential. This is similar to flow through a needle valve. Like a needle valve, as a proportional valve is opened, the rate of flow increases, and if the pressure differential across the valve changes (because of load pressure changes, for example), the flow will vary. Because of this phenomenon, "rated flow" is an arbitrary term, dependent on the above parameters.

Unlike a needle valve, however, proportional valves exhibit an inherent degree of load compensation whereby increasing valve pressure drop has progressively less effect on flow rate (see Power Capacity Envelopes on pages 11 and 23). To eliminate the effects of pressure changes, a hydrostat module can be installed under the proportional valve to achieve pressure compensation.

## Recommended Fluids

Petroleum oils are recommended for use with the KDG4V and KTG4V. Fluorocarbon seals are standard and

are suitable for use with phosphate ester type fluids or blends, water glycol, water-in-oil emulsion fluids, and petroleum oils. Refer to publication 694 for fluid and temperature recommendations. HWBF (95% water) is not recommended.

## Pressure Compensation

For information on using a SystemStak reducing valve to achieve pressure compensation control, please contact your Vickers Representative.

## Accessories

See page 26 for information on mounting surface, subplate, and bolt kits.

## Electrical Signals

It is important to note that solenoid force and valve flow are proportional to current—not voltage. Therefore, for optimum performance, a constant current electrical signal should be used. This type of signal will help compensate for the drift that would otherwise occur when current flow causes solenoid temperature and resistance to increase.

Flow is metered directly in proportion to the command signal applied to the amplifier. Metering performance is enhanced by machined metering notches on the valve spool. As the spool travels from its centered position, these metering notches create an increasingly greater orifice area, allowing more fluid to pass.

## Electrical Connectors

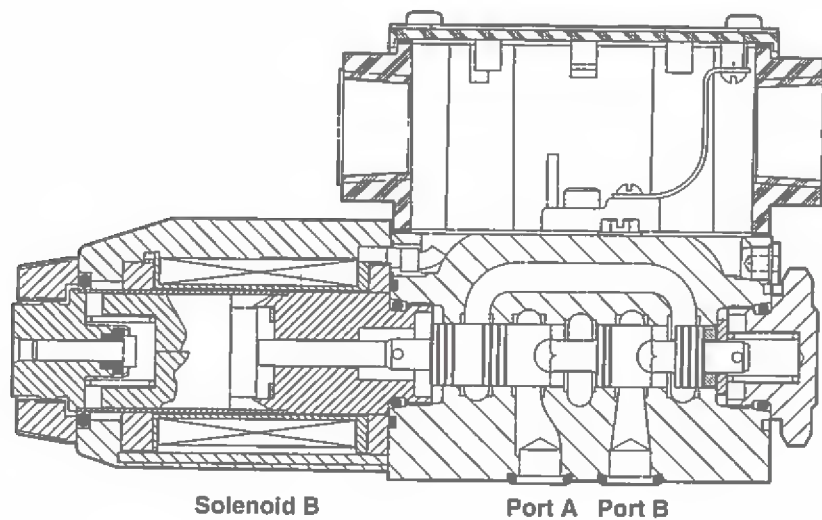
### KDG4V-3S and KTG4V-3S

On FT (flying lead) models, electrical connections to the valve are made in the wiring housing, and a ground terminal is provided. SP1 and SP2 models have spade type terminals on each solenoid. DIN 43650 connectors are also available by specifying the U coil type. When U1 is specified, DIN 443650 mating plugs are included.

### KDG4V-3 and KTG4V-3

DIN 43650 connectors are standard. Mating plugs must be ordered separately.

## Cross Section of Typical Valve (KTG4V-3S)



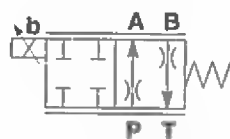
## Graphical Symbols

### KTG4V

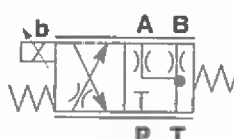
KTG4V-3S-2B\*\*N



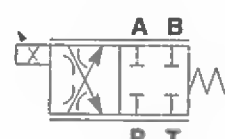
KTG4V-3S-2F\*\*N



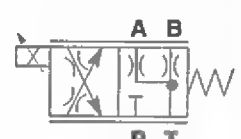
KTG4V-3S-33B\*\*A



KTG4V-3-2B

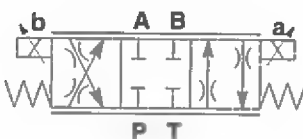


KTG4V-3-33B

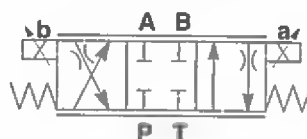


### KDG4V

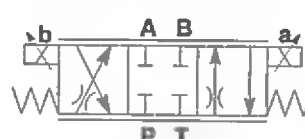
KDG4V-3(S)-2C\*\*N



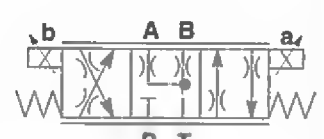
KDG4V-3(S)-2C\*\*S



KDG4V-3S-33C\*\*A



KDG4V-3-33C\*\*N



Note: On all models, when solenoid "a" is energized, flow is always "P" to "A". When solenoid "b" is energized, flow is always "P" to "B". This is in accordance with the ANSI-B93.9 standard. Solenoid designations "a" and "b" are identified on the diagram plate on the side of the valve.

# System Calculations for Valve Selection

The "rated flow" values for this range of proportional valves are determined with a looped flow path pressure drop (e.g. P→A→B→T) of 10 bar (145 psi) when the valve is fully open. As explained on page 2, however, "rated flow" is an arbitrary term dependent upon external factors.

It is important to properly size a proportional valve to achieve good resolution. A common mistake in specifying proportional valves is selecting too high a rated flow. The result may be poor control of the actuator, particularly with respect to velocity and resolution. The ideal valve size is usually one that provides just enough maximum flow to achieve the required actuator velocity.

The following steps can be used to determine the proper size for a proportional valve. This procedure applies to a conventional four-way valve controlling an equal area piston driving a load in an application in which velocity is the critical parameter. For differential area cylinders, base the calculations on the maximum cylinder flow rate.

## Constants

- A = Actuator piston area, cm<sup>2</sup> (in<sup>2</sup>)
- F<sub>M</sub> = Maximum force required, N (lbf)
- F<sub>D</sub> = Force required to accelerate and maintain velocity, N (lbf)
- P<sub>S</sub> = Supply pressure less other system pressure drops, bar (psi)
- P<sub>L</sub> = Maximum pressure required to drive or accelerate actuator under dynamic conditions, bar (psi)
- P<sub>V</sub> = Allowable valve pressure drop, bar (psi)
- V = Desired actuator velocity, m/s (in/s)
- Q = Flow required to drive actuator at desired velocity, L/min (USgpm)

### 1. Determine required actuator area:

$$A(\text{cm}^2) = \frac{F_M(\text{N})}{10 \times P_S(\text{bar})}$$

$$\left[ A(\text{in}^2) = \frac{F_M(\text{lbf})}{P_S(\text{psi})} \right]$$

### 2. Determine flow required to drive actuator at desired velocity:

$$Q(\text{L/min}) = 6 \times A(\text{cm}^2) \times V(\text{m/s})$$

$$\left[ Q(\text{USgpm}) = \frac{A(\text{in}^2) \times V(\text{in/s})}{3.85} \right]$$

### 3. Determine maximum load pressure drop under dynamic conditions:

$$P_L(\text{bar}) = \frac{F_D(\text{N})}{10 \times A(\text{cm}^2)}$$

$$\left[ P_L(\text{psi}) = \frac{F_D(\text{lbf})}{A(\text{in}^2)} \right]$$

### 4. Determine valve pressure drop:

$$P_V(\text{bar}) = P_S(\text{bar}) - P_L(\text{bar})$$

$$[P_V(\text{psi}) = P_S(\text{psi}) - P_L(\text{psi})]$$

### 5. Refer to Flow Gain Curves starting on page 8 and determine most suitable valve spool based on flow (Q) and pressure drop (P<sub>V</sub>).

### 6. Refer to Power Capacity Envelopes on page 11 and verify that flow (Q) determined in step 2 at the valve pressure drop (P<sub>V</sub>) determined in step 4 falls within (to the left of) the power curve for the spool selected in step 5.

## Example

A hydraulic system consisting of a pressure compensated pump, proportional valve, and equal area cylinder must develop a maximum force of 6400 N (1440 lbf) and move a 200 N (45 lbf) load at a velocity of 0,25 m/s (9.84 in/s). The force required to maintain this velocity is 1000 N (225 lb), and the pump's compensator is set at 60 bar (870 psi).

### 1. Determine required actuator area:

$$A = \frac{F_M}{10 \times P_S} = \frac{6400}{10 \times 60} = 10,7 \text{ cm}^2$$

$$\left[ A = \frac{F_M}{P_S} = \frac{1440}{870} = 1.66 \text{ in}^2 \right]$$

\* 2 inch bore, 1.375 inch rod cylinder has actuator area = 1.66 in<sup>2</sup>

### 2. Determine flow required to drive actuator at desired velocity:

$$Q = 6 \times A \times V$$

$$= 6 \times 10,7 \times 0,25 = 16,1 \text{ L/min}$$

$$\left[ Q = \frac{A \times V}{3.85} \right]$$

$$= \frac{1.66 \times 9.84}{3.85} = 4.24 \text{ USgpm}$$

### 3. Determine maximum load pressure drop under dynamic conditions:

$$P_L = \frac{F_D}{10 \times A}$$

$$= \frac{1000}{10 \times 10,7} = 9,4 \text{ bar}$$

$$\left[ P_L = \frac{F_D}{A} = \frac{225}{1.66} = 136 \text{ psi} \right]$$

### 4. Determine valve pressure drop:

$$P_V = P_S - P_L$$

$$= 60 - 9,4 = 50,6 \text{ bar}$$

$$[P_V = P_S - P_L]$$

$$= 800 - 136 = 734 \text{ psi}$$

### 5. Refer to Flow Gain Curves and determine most suitable valve spool based on flow (Q) and pressure drop (P<sub>V</sub>):

Calculated flow (Q) is 16,1 L/min (4.24 USgpm), and valve pressure drop (P<sub>V</sub>) is 50,6 bar (734 psi). Reference to the KDG4V-3S "Flow Gain" graphs (see page 8) shows that the 15N spool (meter-in and meter-out) will do the job. A KDG4V-3S-2C15N would be selected.



# Model Code – K\*G4V-3S Standard Performance Valves

**K \* G 4 V - 3 S - \* \* \* (L) \* \* \* - ( \* \* ) - (V) M \* \* \* \* \* (1) - \* \* 5 - 60 - (EN \* \*)**

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23

## 1 Valve type

K – Proportional

## 2 Valve function

D – Directional valve (Double solenoid, C models. See item 9.)

T – Throttle valve (Single solenoid, B and F models. See item 9.)

## 3 Mounting

G – Subplate/manifold mounted

## 4 Operation

4 – Solenoid operated

## 5 Pressure rating

V – 350 bar (5075 psi) on P, A, and B ports

## 6 Interface

3 – ISO 4401-03, CETOP 3 (NFFA D03)

## 7 Performance

S – Standard performance

## 8 Spool type (center condition)

2 – Closed center (all ports)

33 – P port closed, bleed A and B to T

## 9 Spool/spring arrangement

B – Spring centered, solenoid A removed

C – Spring centered, dual solenoid

F – Spring offset to A port, shift to center

## 10 Build

L – Left-hand build (single solenoid only)

Blank – Standard right-hand build

## 11 Spool flow rating

For looped flow path P→A→B→T or P→B→A→T:  $\Delta p=10$  bar (145 psid).

For single flow path P→A or B→T:  $\Delta p=5$  bar (72 psi).

08 – 8 L/min (2 USgpm)

15 – 15 L/min (4 USgpm)

19 – 19 L/min (5 USgpm)

22 – 22 L/min (5.8 USgpm) – available with KDG4V-3S-33C22A only

## 12 Metering condition

S – Meter out only

A – Meter in only

N – Meter in and meter out

*Note: See table on page 6 for available combinations of spools, spool/spring arrangements, and metering conditions.*

## 13 Manual override

P2 – Plain override in both ends of single solenoid models

H – Waterproof override in solenoid ends only

Blank – Plain override in solenoid ends only

## 14 Solenoid energization identity

V – Solenoid identification determined by position of solenoid (solenoid A on A port end, solenoid B on B port end)

Blank – Standard per ANSI B93.9 (energize solenoid A, flow is (P→A))

## 15 Flag symbol

M – Electrical options and features

## 16 Coil type

F – Flying lead and wiring box

U – DIN 43650 connector

SP1 – Single 6,3 mm spade IEC-760 (direct DC only)

SP2 – Dual 6,3 mm spade IEC-760

## 17 Electrical connections

T – Wiring terminal block

PA3 – 3-pin conduit connector

PA5 – 5-pin conduit connector

## 18 Wiring housing thread

W – 1/2" NPT

J – 20 mm

## 19 Electrical options

1 – ISO 4400 with DIN 43650 plug supplied (U coil type models only)

## 20 Coil voltage rating

G – 12V DC\*

H – 24V DC\*

GP – Direct 12V DC or EM-VP/VT amplifier

HA – Direct 24V DC or EM-VP/VT amplifier

\* Amplified models, current controlled

## 21 Tank pressure rating

5 – 100 bar (1450 psi) for

## 22 Design number

Subject to change.

## 23 Special modifications

EN-427 – Applies to KTG4V only. One spool designation only and preset adjuster; see page 14.

*Note: This valve is recommended for use with Vickers Valvistor® control valve.*



# KDG4V-3S and KTG4V-3S Application Data

## Specifications

**Maximum operating pressure (A, B and P ports)**  
350 bar (5000 psi)  
(See "Flow Gain Curves")

**Maximum tank line pressure (T port)**  
K\*G4V-3S: 100 bar (1450 psi)

**Maximum recommended pressure drop (four-way models at max. flow)**  
210 bar (3000psi)\*

\*At pressure drops above 10 bar (145 psid) dither amplitudes in the electronic controller may need to be set at or near minimum to eliminate potential high frequency circuit noise.

### Mounting pattern

ISO-4401-AB-03-4-A, NFPA D03, CETOP 3

**Operating temp** ... 20° to 82°C  
(-4° to 180°F)

**Fluid viscosity** ..... 16 – 54 cSt  
(75–250 SUS)

### Weights (approximate)

KDG4V-3S†-60 ... 2,3 kg (5.06 lbs.)  
KTG4V-3S†-60 ... 1,75 kg (3.85 lbs.)

## Performance

### Frequency Response

18Hz @ -3db  
(10Hz @ 45 degree phase lag)  
For an amplitude of 25% max stroke (center to offset) about the 50% position and ΔP (P-A-B-T) = 10 bar (145 psid). See graph on page 12.

### Hysteresis

With pulse width modulation 4%  
With direct DC voltage  
(GP & HA) ..... 8%

**Repeatability** ..... 1%

**Deadband** ..... 15–35%  
of full solenoid input. Vickers electronic controllers have a deadband eliminator to reduce this value to near zero.

## Solenoid Specifications

### Maximum current @ 50°C (122° F) ambient

G ..... 3.2A  
H ..... 1.6A

### Power Consumption @ 20°C (68° F)

G ..... 18 Watts  
H ..... 18 Watts  
GP ..... 30 Watts  
HA ..... 30 Watts

### Coil Resistance @ 20°C (68° F)

G ..... 1.8 Ohms  
H ..... 7.3 Ohms  
GP ..... 4.9 Ohms  
HA ..... 19.6 Ohms

### Coil Inductance @ 1000 Hz

G ..... 7.5 mH  
H ..... 29 mH  
GP ..... 16 mH  
HA ..... 67 mH

## Step Response Time

The following response times were measured from the point of energization/de-energization to the point of first indication of inlet pressure change.

Response up to full system pressure is dependent on the system's compressed volume and can vary with each application.

**0–100% (center to full spool travel)**  
100 msec

**100–0% (full spool travel to center – fast drop out)**  
15 msec

**10–90% (10% full flow to 90% full flow)** 100 msec

**90–10% (90% full flow to 10% full flow)** 25 msec

**100–100% (100% full flow travel in one direction to 100 % full flow travel in the reverse direction)**  
80 msec

## Spool, Spool/Spring, Metering

Refer to the table below for the available spools, spool/spring arrangements and metering conditions.

For example, if a KD valve with a "33" spool is required, the spool/spring arrangement is "C" and the metering condition available is "A". Refer to "Model Code" for a definition of these codes.

Model	Spool	Spool/Spring Arrangement	Metering Condition
KD	2	C	N or S
	33	C	A
KT	2	B or F	N
	33	B	A

## Amplifiers


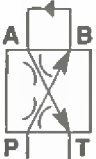



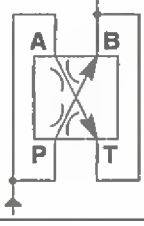

Coil Voltage Identification Letter	Amplifier
G	No amplifier
H	EEA-PAM-523-A-30
	EEA-PAM-523-B-30
	EEA-PAM-523-C-30
	EEA-PAM-523-D-30
	EEA-PAM-523-E-30
	EEA-PAM-523-F-30
H	EEA-PAM-520-A-14 (for use with EN427 models)
GP	EM-VT-12-10† EM-VP-12-10†
HA	EM-VT-24-10† EM-VP-24-10†
	<b>Plug Amplifier</b>
H	EHH-AMP-702-C-10
	EHH-AMP-702-D-10
	EHH-AMP-702-E-10
	EHH-AMP-702-F-10

† Refer to drawing I-521575 for information.

## Drain

On 2-way valves, "T" is the drain and must be connected to the tank through a surge-free line, so there will be no back pressure at this port.

# KDG4V-3S and KTG4V-3S Flow Paths

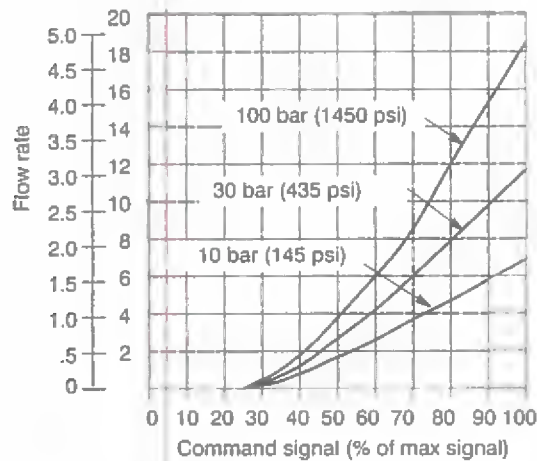
Valve/Flow Path	Spool	Symbol
KDG4V-3S with Looped Flow Path. P→A or B, plus B or A→T	2C08S 2C15S 2C19S	
	2C08N 2C15N 2C19N	
	33C08A 33C15A 33C22A	
KDG4V-3S with Single Flow Path. P→A or B, or A or B→T	2C08N 2C15N 2C19N	
KTG4V-3S with Single Flow Path. P→A or B, or A or B→T	2B08N 2B15N 2B19N	
KTG4V-3S with Parallel Flow Path. P→B and A→T	2B08N 2B15N 2B19N	
KTG4V-3S with Looped Flow Path. P→A or B, plus B or A→T	2B08N 2B15N 2B19N	

# KDG4V-3S Flow Gain Curves

At the stated valve pressure drops, the percentage command signals are applicable to whichever solenoid is energized.

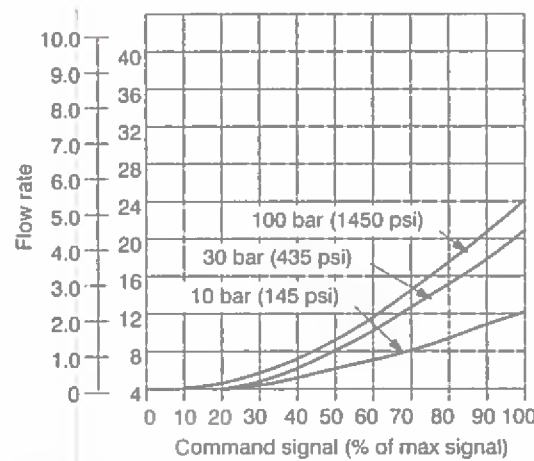
## Looped Flow Path

USgpm l/min Spool "2C08S" P-A or B plus B or A-T

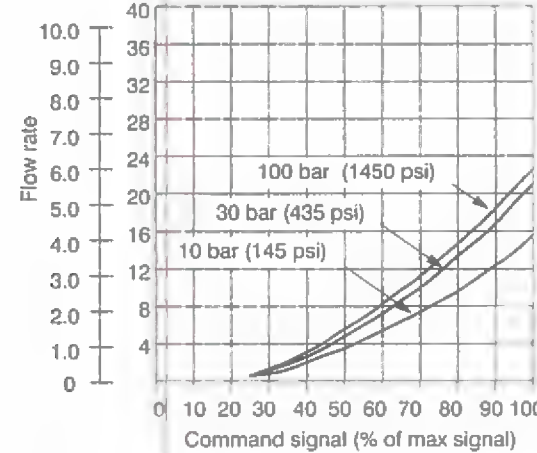


## Looped Flow Path

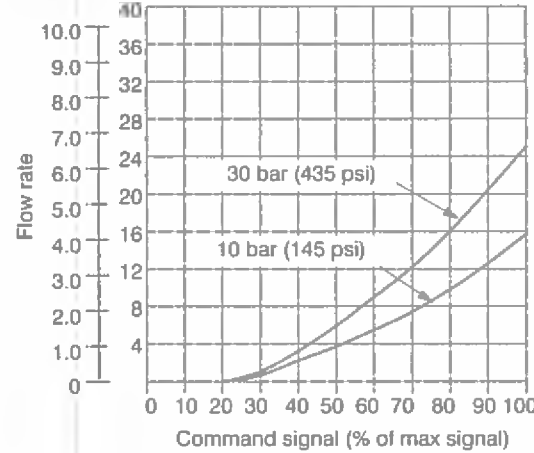
USgpm l/min Spool "2C08N" P-A or B, or A or B-T



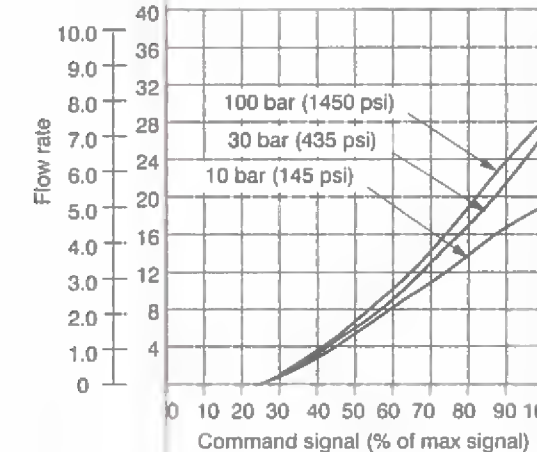
USgpm l/min Spool "2C15S" P-A or B plus B or A-T



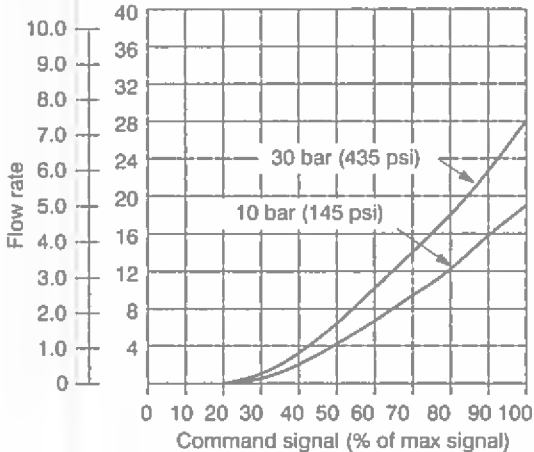
USgpm l/min Spool "2C15N" P-A or B, or A or B-T



USgpm l/min Spool "2C19S" P-A or B plus B or A-T



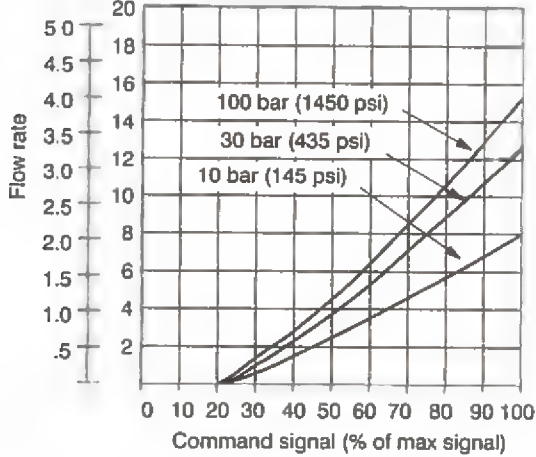
USgpm l/min Spool "2C19N" P-A or B, or A or B-T



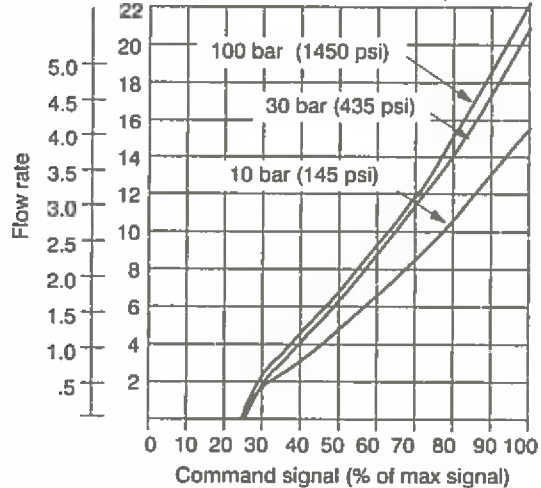
At the stated valve pressure drops, the percentage command signals are applicable to whichever solenoid is energized.

## Looped Flow Path

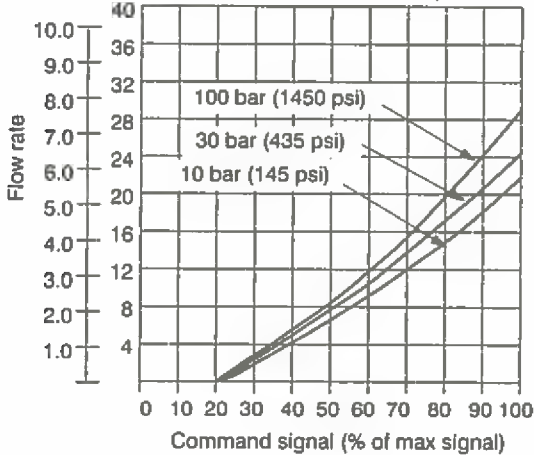
USgpm I/min Spool "33C08A" P-A or B plus B or A-T



USgpm I/min Spool "33C15A" P-A or B plus B or A-T

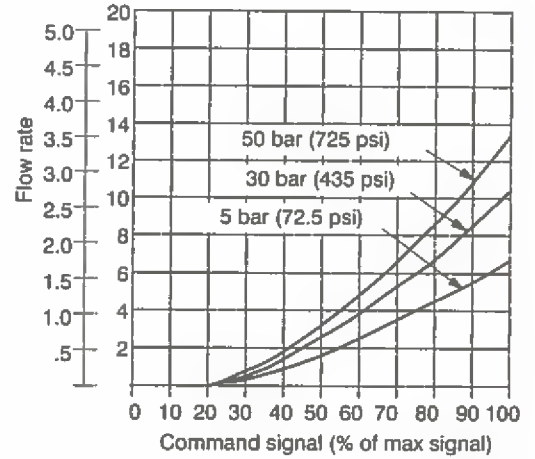


USgpm I/min Spool "33C22A" P-A or B plus B or A-T

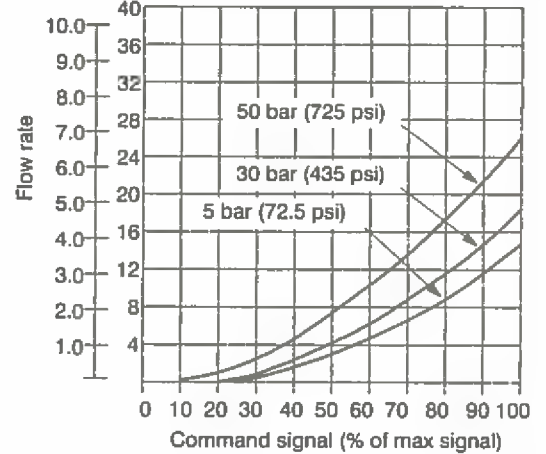


## Single Flow Path

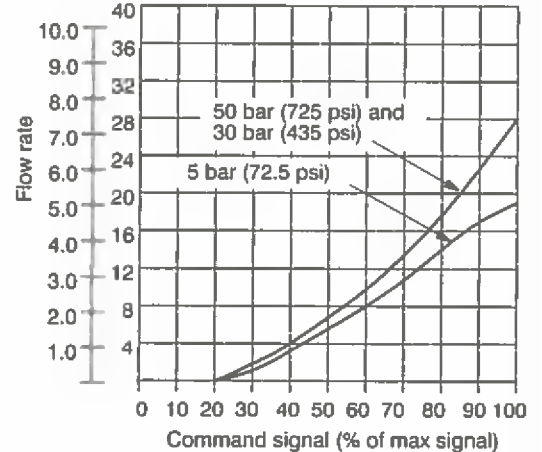
USgpm I/min Spool "2C08N" P-B or A-T



USgpm I/min Spool "2C15N" P-B or A-T



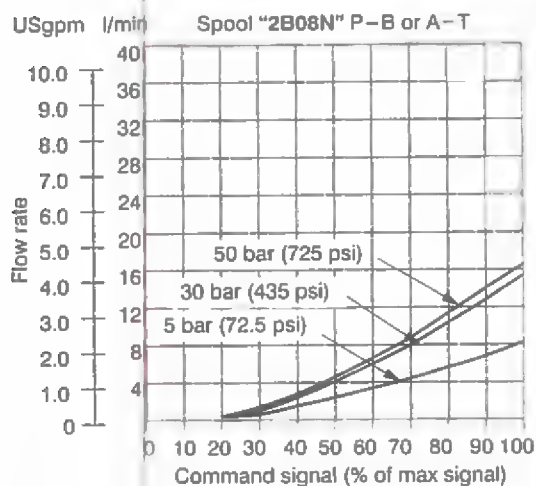
USgpm I/min Spool "2C19N" P-B or A-T



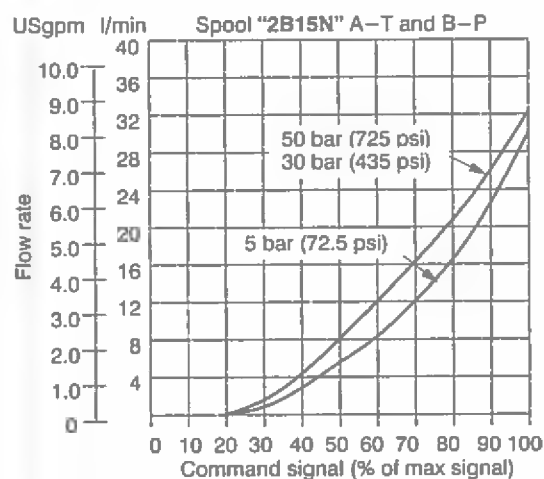
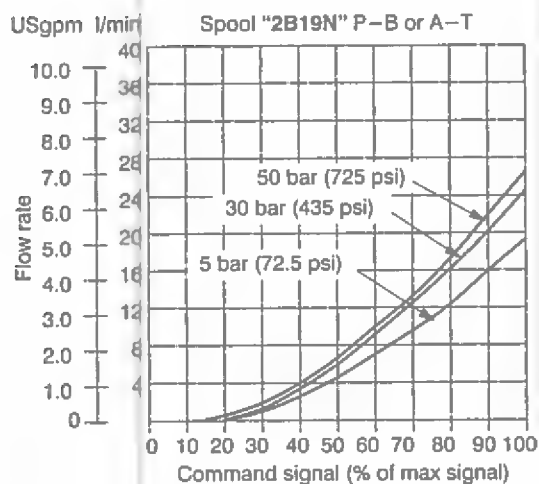
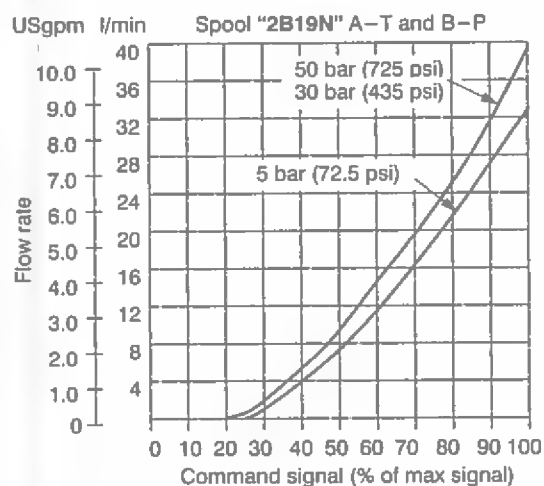
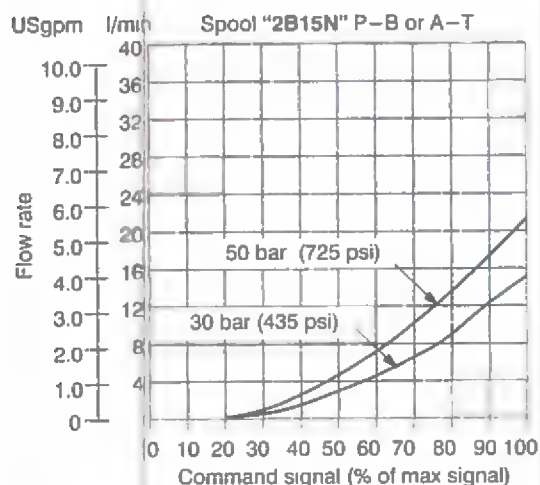
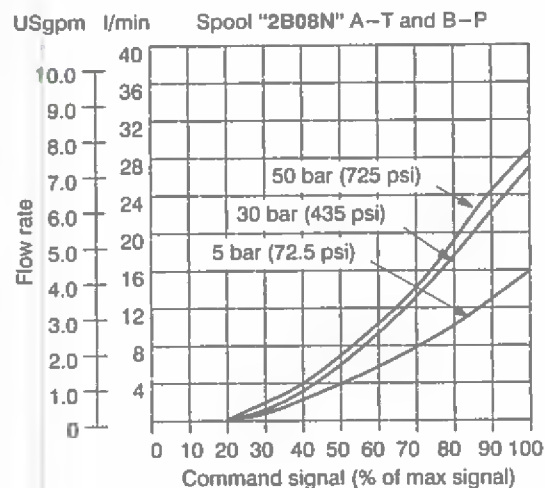
# KDG4V-3S Flow Gain Curves

At the stated valve pressure drops, the percentage command signals are applicable to whichever solenoid is energized.

## Single Flow Path

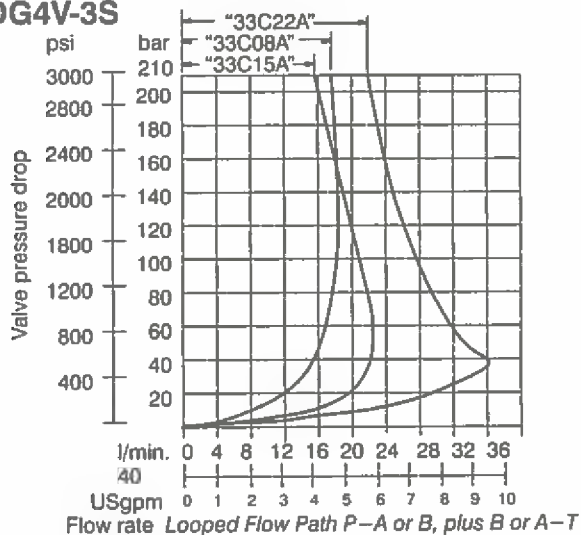


## Parallel Flow Path

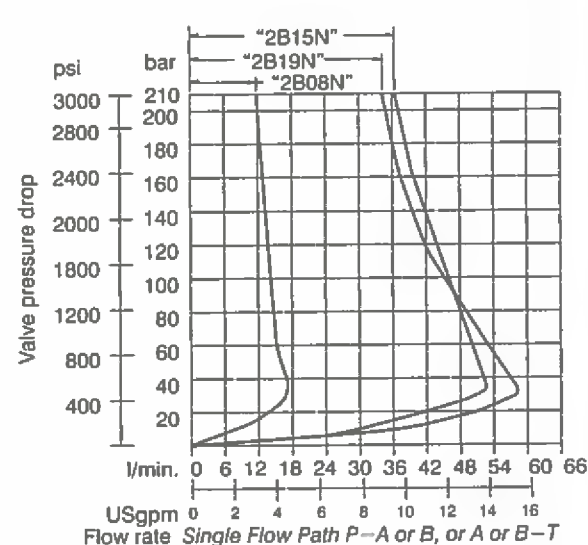
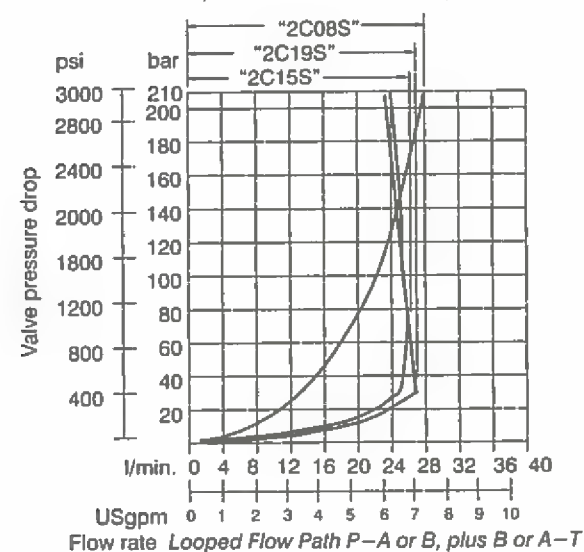
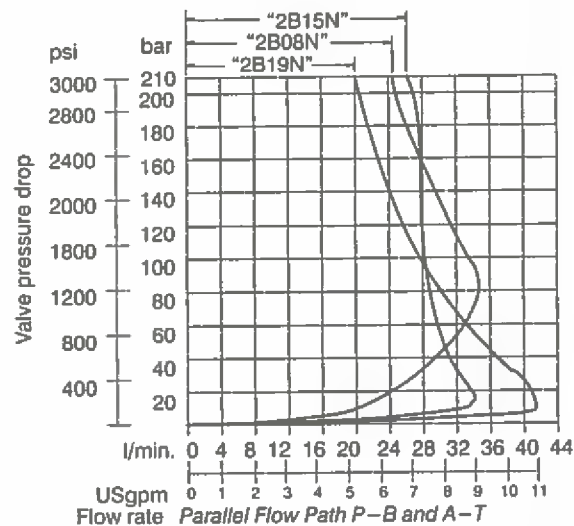
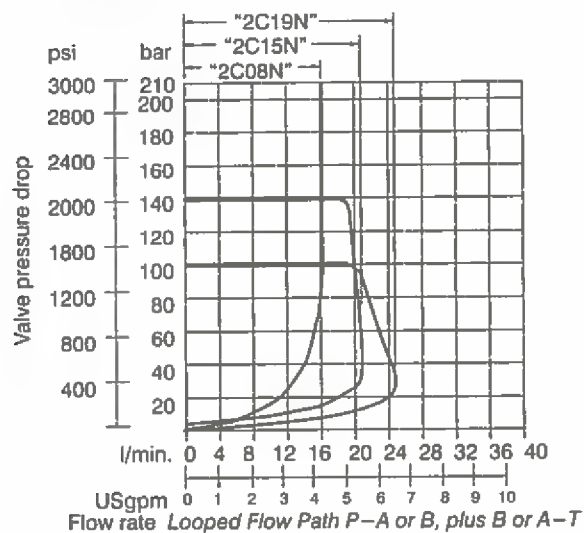
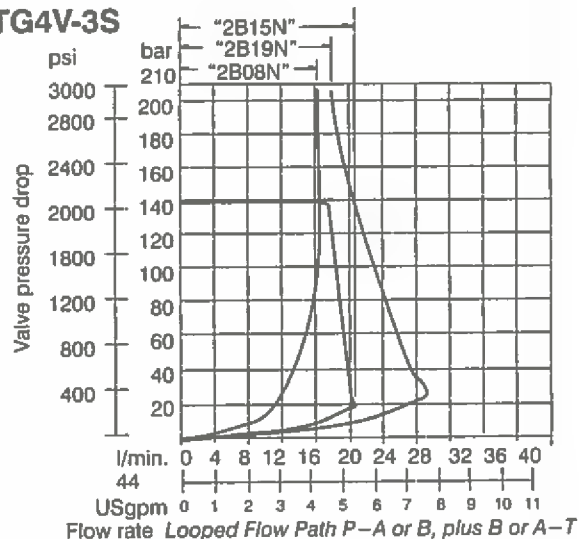


# KDG4V-3S and KTG4V-3S Power Capacity Envelopes

**KDG4V-3S**



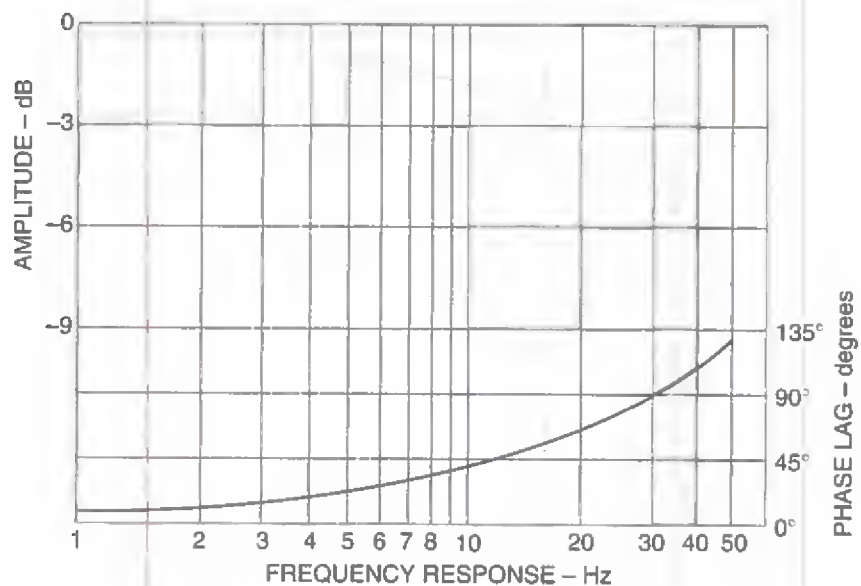
**KTG4V-3S**





## KDG4V-3S and KTG4V-3S Frequency Response

For amplitude of  $\pm 25\%$  maximum stroke  
(center to offset) about 50% position and  
 $\Delta p$  (P→A→B→T)=10 bar (145 psi).

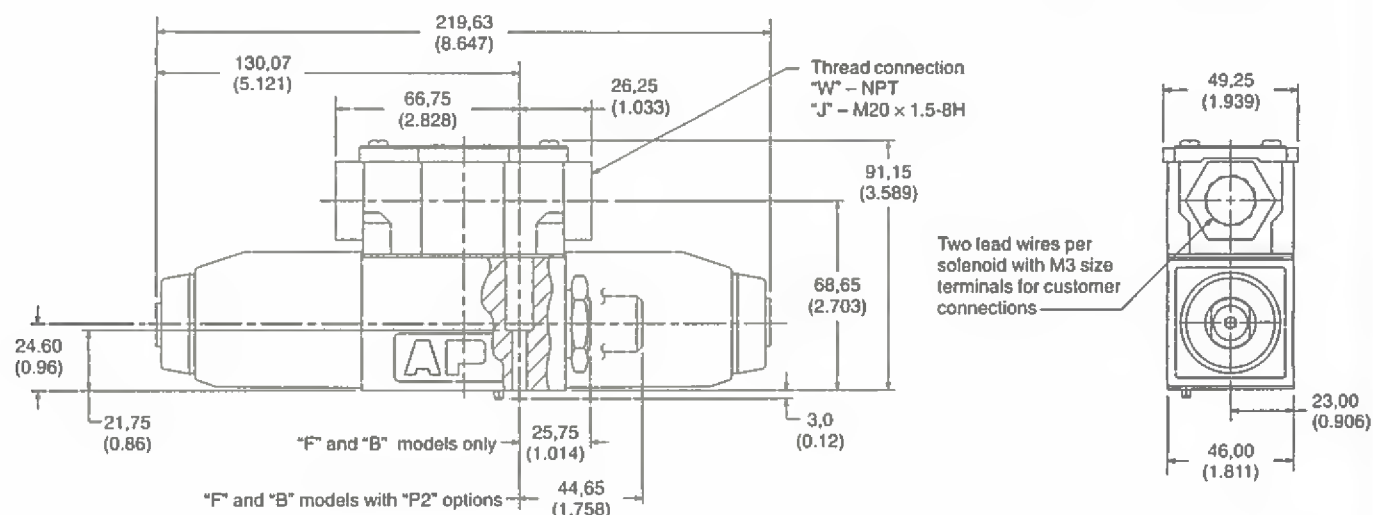


# KDG4V-3S and KTG4V-3S Installation Dimensions

## KDG4V-3S and KTG4V-3S with Junction Box

Dimensions in mm (inches)

3rd angle projection



## Water-resistant Manual Override on Solenoid

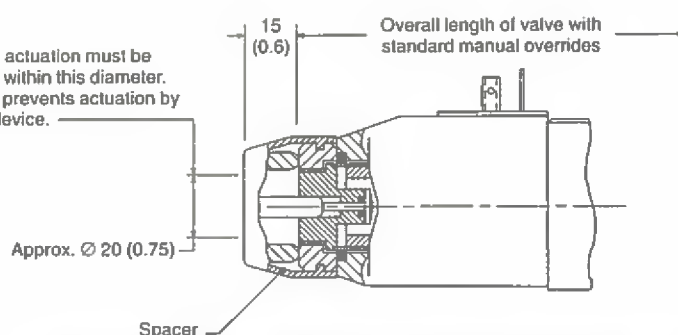
K\*G4V-3S-\*\*(L)-H-(V)M-\*\*-\*\*-60

Dimensions in mm (inches)

Use where finger operation is required.  
(Standard manual overrides cannot be operated without using small tool.)

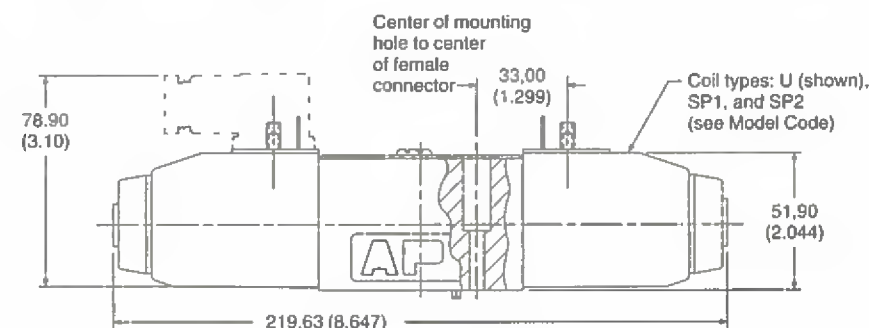
This "H" feature is not field-convertible from other models. Please specify with order.

Manual actuation must be applied within this diameter. Spacer prevents actuation by larger device.



## KDG4V-3S (shown) and KTG4V-3S with DIN Connectors

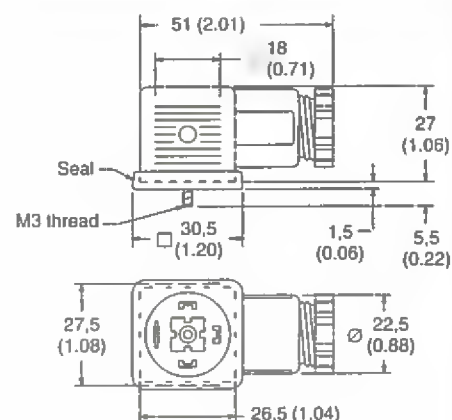
Dimensions in mm (inches).



Plug connector can be positioned in 90° increments on valve by removing connector housing and re-assembling contact holder at desired orientation inside housing.

DIN 43650 plug connector can be ordered separately or included with valve by specifying 1 for Model Code item 19.

Means of connection: screw terminals



Conductor cross-sectional area: 0,5 to 1,5 mm<sup>2</sup> (0.0008 to 0.0023 in<sup>2</sup>)

Cable diameter: 6 to 10 mm (0.24 to 0.40 in)

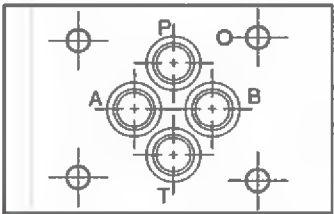
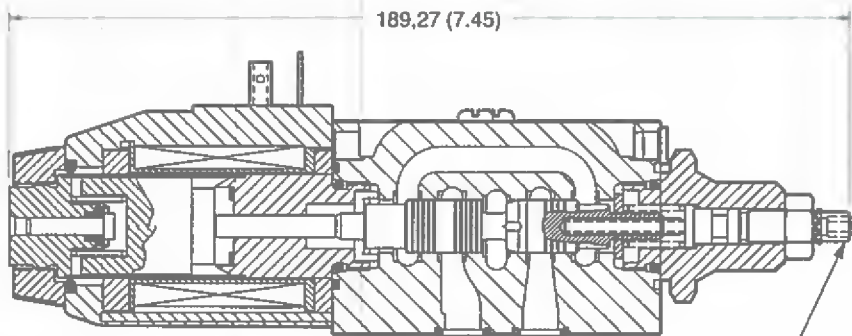
# KTG4V-3S with EN427 Feature

KTG4V-3S-2B 08N-(V)M-\*\*\* \*\*\*(1)-H5-60-EN427



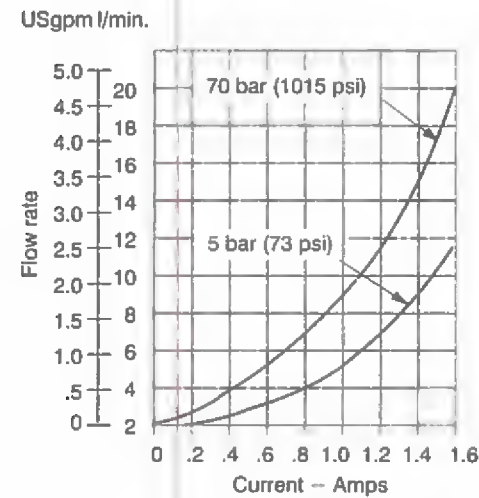
This valve feature is recommended for use as a pilot valve with the Valvistor® Slip-in Cartridge Valve.

The spool adjuster is preset at the factory. Do not adjust.

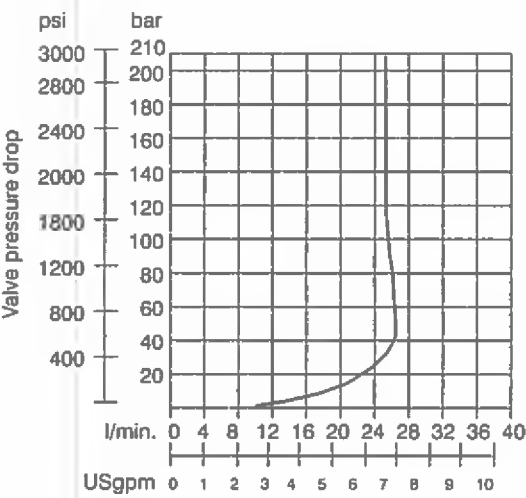


## EN427 Performance

### Flow Gain Curve



### Power Capacity Curve



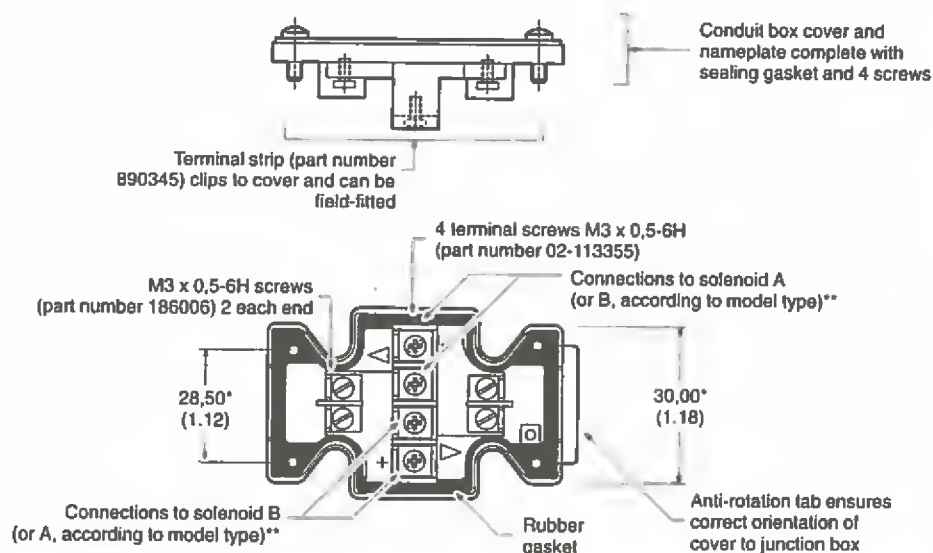
# KDG4V-3S and KTG4V-3S Electrical Connections

## Terminal Strip for FT (Flying Lead) Models

Dimensions in mm (inches)

\* Difference in dimensions helps ensure correct orientation of nameplate to valve.

\*\* For DC coils, positive + lead(s) must be connected to terminal(s) marked +. When using 3-wire incoming leads to double solenoid valves (i.e. common neutral), inner pair of terminals must be interconnected.



## NFPA Connector (Standard T.3.5.29-1980) for FPA3 and FPA5 Models

Dimensions in mm (inches)

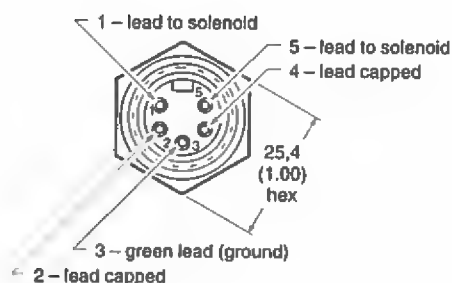
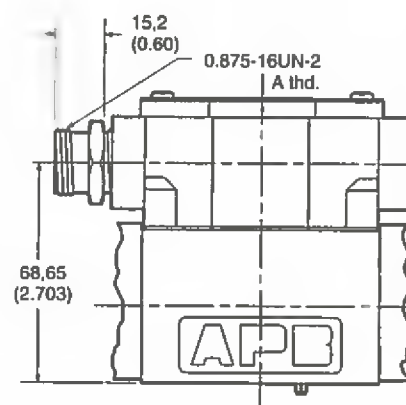
The receptacle is a standard three-pole or five-pole electrical connector with shortened leads and terminals added. The five-pole plug has four leads 101,6 (4.0) long and one lead 177,8 (7.0) long. All wires have non-solder insulated eyelet terminals. The green wire is used for the ground connection (No. 8 screw furnished). Valves are supplied pre-wired.

### WARNING

Electrical power must be disconnected before removing or replacing this receptacle.

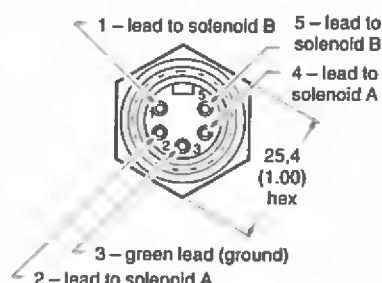
Electrical connection is over solenoid A on single solenoid models and over solenoid B on dual solenoid models. See diagram plate for solenoid B location.

Receptacle is pre-wired to solenoid eyelets. Connection is made with No. 6 screws and nuts insulated with black electrical tape.



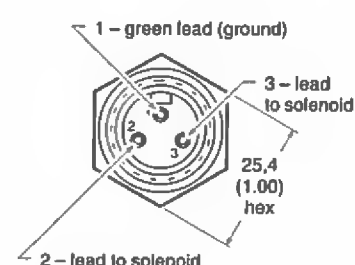
**KTG4V-3S-\*\*-M-FPA5**

B models  
F models



**KDG4V-3S-\*C-M-FPA5**

C models



**KTG4V-3S-\*\*-M-FPA3**

B models  
F models

# Model Code – K\*G4V-3 High Performance Valves

**K \* G 4 V - 3 - \* \* \* \* \* - ( \* ) - ( V ) M - U - \* \* 7 - 6 0**

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

## 1 Valve type

K – Proportional

## 2 Valve function

D – Directional valve (Double solenoid, C models. See item 8.)  
T – Throttle valve (Single solenoid, B models. See item 8.)

## 3 Mounting

G – Subplate/manifold mounted

## 4 Operation

4 – Solenoid operated

## 5 Pressure rating

V – 350 bar (5075 psi) on P, A, and B ports

## 6 Interface

3 – ISO 4401-03, CETOP 3 (NFPA D03)

## 7 Spool type (center condition)

2 – Closed center (all ports)  
33 – P port closed, bleed A and B to T

## 8 Spool/spring arrangement

B – Spring centered, solenoid A removed – KTG4V-3  
C – Spring centered, dual solenoid – KDG4V-3

## 9 Spool flow rating

For looped flow path P→A→B→T or P→B→A→T:  $\Delta p = 10$  bar (145 psi).

For single flow path P→A or B→T:  $\Delta p = 5$  bar (72 psi).

### Symmetric Spools

03F – 3 l/min (0.8 USgpm)  
07N – 7 l/min (1.8 USgpm)  
13N – 13 l/min (3.4 USgpm)  
20N – 20 l/min (5.3 USgpm)  
28S – 28 l/min (7.4 USgpm) – available with type 2 spool only

### Asymmetric Spool – KDG4V Only

First figure (20N) is flow rating P→A or A→T; last figure (N10) is flow rating P→B or B→T.

20N10 – 20 l/min (5.3 USgpm) "A" port flow, and 10 l/min (2.65 USgpm) "B" port flow

## 10 Manual override(s)

H – Water-resistant  
Z – No override(s)  
Blank – Plain override(s)

## 11 Solenoid energization identity

V – Solenoid identification determined by position of solenoid (solenoid A on A port end, solenoid B on B port end)  
Blank – Standard per ANSI B93.9 (energize solenoid A, flow is P→A)

## 12 Flag symbol

M – Electrical options and features

## 13 Coil type

U – DIN 43650 connector. Order solenoid plug separately; see page 25.

## 14 Coil voltage rating

G – 12V DC\*  
H – 24V DC\*  
GP – Direct 12V DC or EM-VP/VT amplifier  
HA – Direct 24V DC or EM-VP/VT amplifier

\* Amplified models, current controlled

## 15 Tank pressure rating

7 – 210 bar (3000 psi)

## 16 Design number

Subject to change.

# KDG4V-3 and KTG4V-3 Application Data

## Specifications

### Maximum operating pressure

(A, B and P ports)

350 bar (5000 psi)

(See "Flow Gain Curves")

### Maximum tank line pressure (T port)

210 bar (3000 psi)

### Maximum recommended pressure drop (four-way models at max. flow)

210 bar (3000 psi)\*

\*At pressure drops above 10 bar (145 psid) dither amplitudes in the electronic controller may need to be set at or near minimum to eliminate potential high frequency circuit noise.

### Minimum recommended flow rates for KDG4V-3

Spool Code	l/min	in <sup>3</sup> /min
**C03F	0,2	12
**C07F	0,4	24
**C13F	0,6	36
**C20F	1,0	60
**C28S	1,4	85

### Mounting pattern

ISO-4401-AB-03-4-A, NFPA D03, CETOP 3

Operating temp ... 20° to 82°C  
(-4° to 180°F)

Fluid viscosity ..... 16 – 54 cSt  
(75–250 SUS)

### Weights (approximate)

KDG4V-3\*-60 .... 2,4 kg (5.30 lbs.)

KTG4V-3\*-60 .... 1,70 kg (3.75 lbs.)

## Performance

### Frequency Response

See graph on page 12.

### Hysteresis

At  $\Delta p = 5$  bar (72 psi) ..... < 8% at rated flow

### Reproducibility, valve-to-valve

Optimized by adjustment of deadband compensation, gain and ramp potentiometers on associated Vickers amplifier.

## Solenoid Specifications

### Maximum current @ 50°C (122° F) ambient

G	3.5A
H	1.6A
GP	3.0A
HA	0.94A

### Coil Resistance @ 20°C (68° F)

G	1.55 Ohms
H	7.3 Ohms
GP	2.0 Ohms
HA	22.1 Ohms

### Coil Inductance @ 1000 Hz

G	4 mH
H	20 mH
GP	6 mH
HA	55 mH

### Relative duty factor

Continuous rating ED = 100%

### Type of protection, with electrical plugs fitted correctly

IEC 144 Class IP65

## Step Input Response

At  $\Delta p = 5$  bar (72 psi) per metering path.

Required step:	Time to reach 90% of req'd step:
0 to 100% .....	25 ms
100% to 0 .....	30 ms
+90 to -90% ...	35 ms

## Amplifiers

Coil Voltage Identification Letter	Amplifier
G	No amplifier
H	EEA-PAM-523-A-30
	EEA-PAM-523-B-30
	EEA-PAM-523-C-30
	EEA-PAM-523-D-30
	EEA-PAM-523-E-30
	EEA-PAM-523-F-30
GP	EM-VT-12-10† EM-VP-12-10†
HA	EM-VT-24-10† EM-VP-24-10†
H	Plug Amplifier
	EHH-AMP-702-C-10
	EHH-AMP-702-D-10
	EHH-AMP-702-E-10
	EHH-AMP-702-F-10

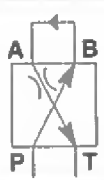
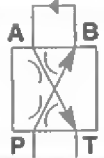


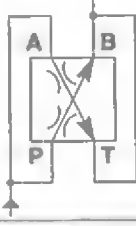


† Refer to drawing I-521575 for information.

## Drain

On 2-way valves, "T" is the drain and must be connected to the tank through a surge-free line, so there will be no back pressure at this port.



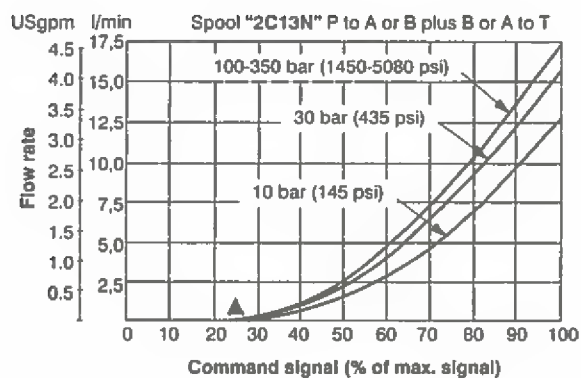
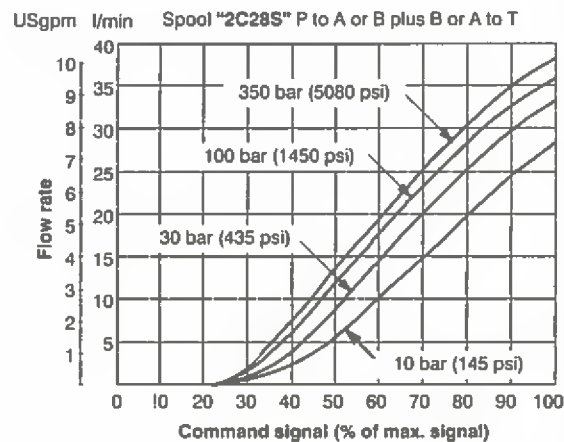
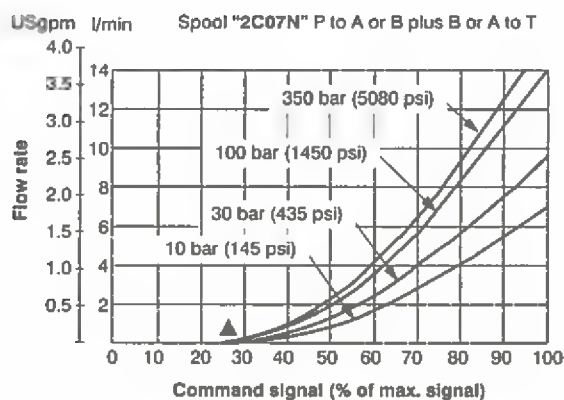
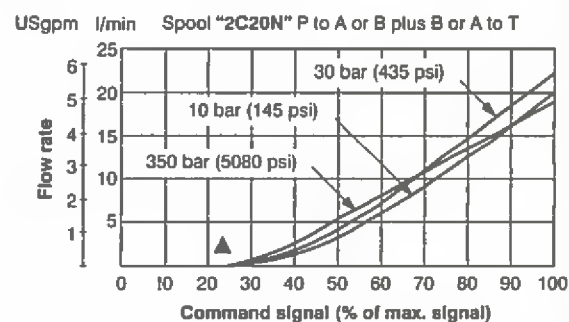
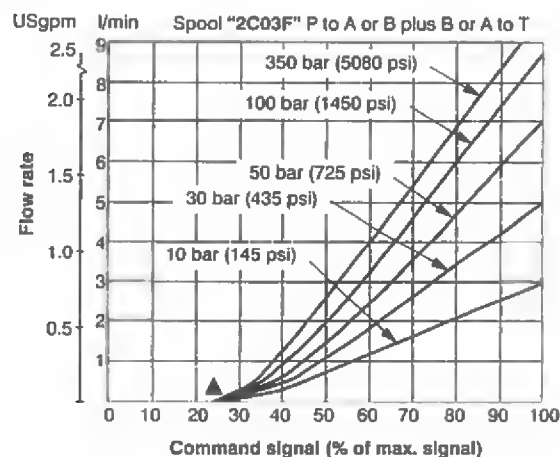
# KDG4V-3 and KTG4V-3 Flow Paths

Valve/Flow Path	Spool	Symbol
KDG4V-3 with Looped Flow Path. P→A or B, plus B or A→T	**C28S	
	**C03F **C07N **C13N **C20N	
KDG4V-3 with Single Flow Path. P→A or B, or A or B→T	**C03F **C07N **C13N **C20N	
KTG4V-3 with Single Flow Path. P→A or B, or A or B→T	**B03F **B07N **B13N **B20N	
KTG4V-3 with Parallel Flow Path. P→B and A→T	**B13N **B20N	
KTG4V-3 with Looped Flow Path. P→A or B, plus B or A→T	**B03N **B07N **B13N	
KTG4V-3 with Looped Flow Path. P→A or B, plus B or A→T	**B28S	

# KDG4V-3 Flow Gain Curves

At the stated valve pressure drops, the percentage command signals are applicable to whichever solenoid is energized.

## Looped Flow Path

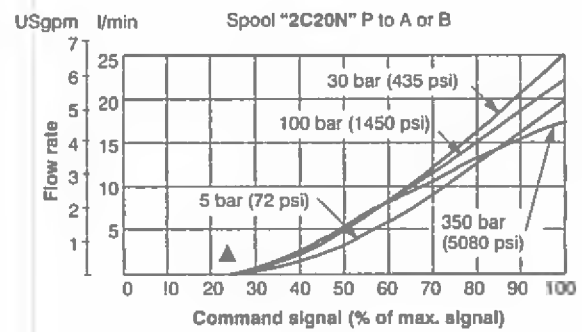
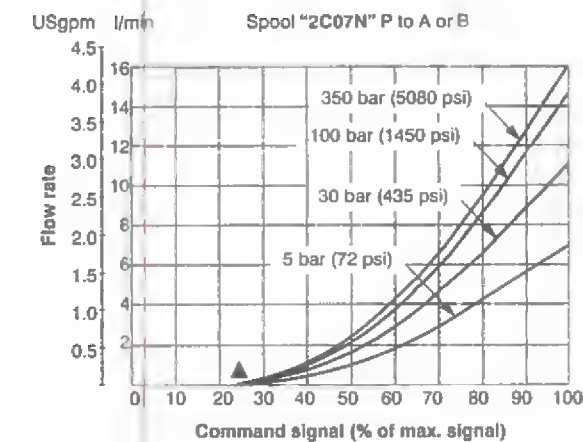
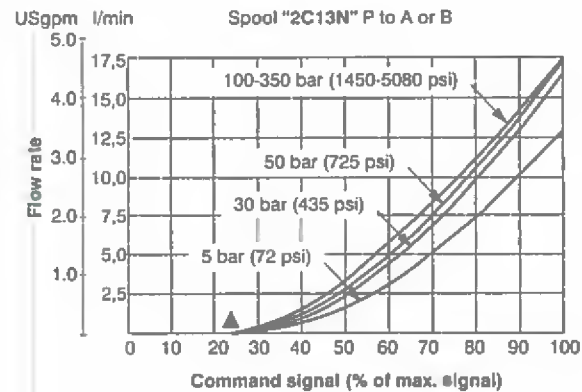
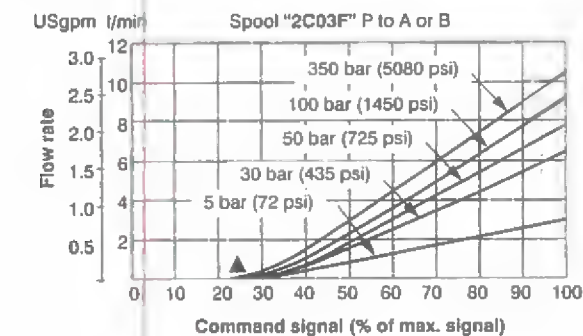


▲Curves shown are for spool types "2". These points will vary from valve to valve, but can be adjusted using the deadband-compensation feature of the drive amplifier. For spool types "33", the curves are similar, but flow starts at slightly higher command signals.

# KDG4V-3 Flow Gain Curves

At the stated valve pressure drops, the percentage command signals are applicable to whichever solenoid is energized.

## Single Flow Path

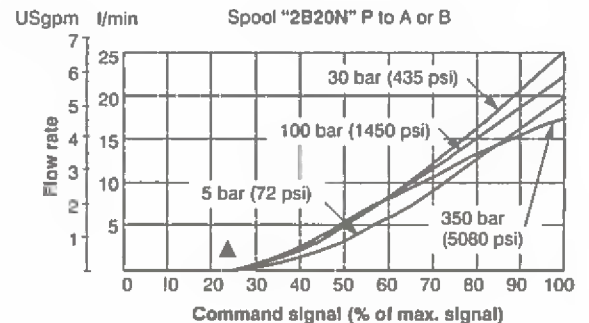
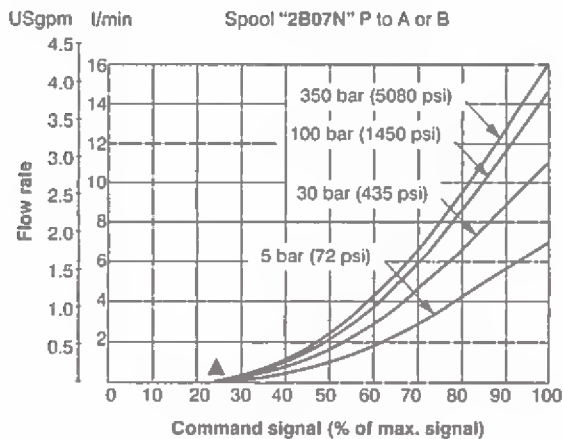
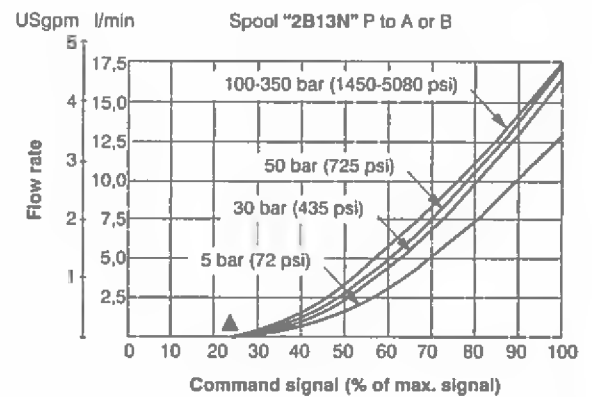
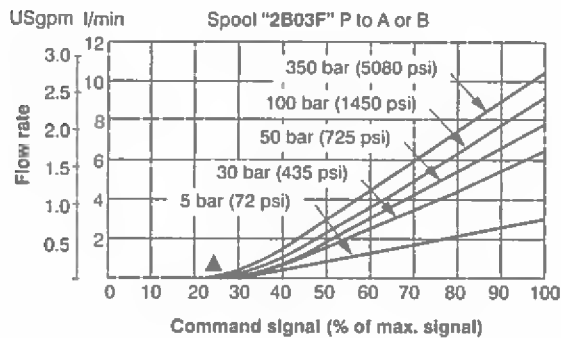


▲ Curves shown are for spool types "2". These points will vary from valve to valve, but can be adjusted using the deadband-compensation feature of the drive amplifier. For spool types "33", the curves are similar, but flow starts at slightly higher command signals.

# KTG4V-3 Flow Gain Curves

At the stated valve pressure drops, the percentage command signals are applicable to whichever solenoid is energized.

## Single Flow Path

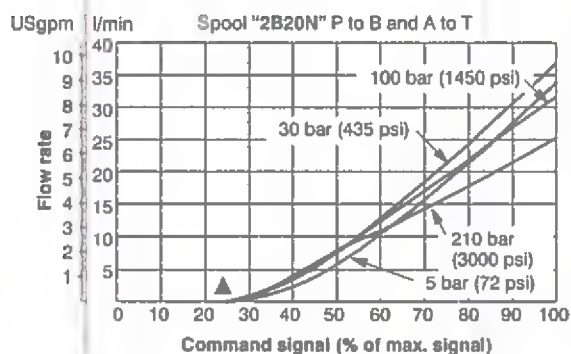
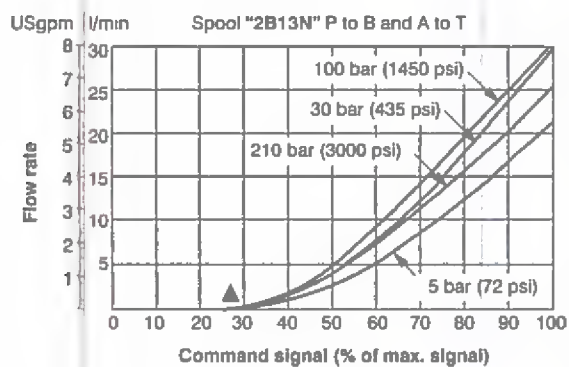


▲Curves shown are for spool types "2". These points will vary from valve to valve, but can be adjusted using the deadband-compensation feature of the drive amplifier. For spool types "33", the curves are similar, but flow starts at slightly higher command signals.

# KTG4V-3 Flow Gain Curves

At the stated valve pressure drops, the percentage command signals are applicable to whichever solenoid is energized.

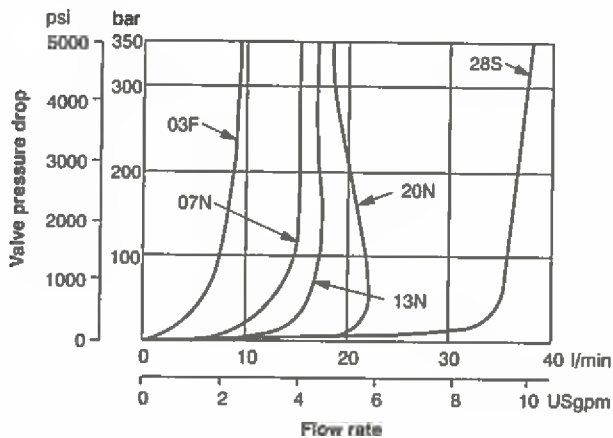
## Parallel Flow Path



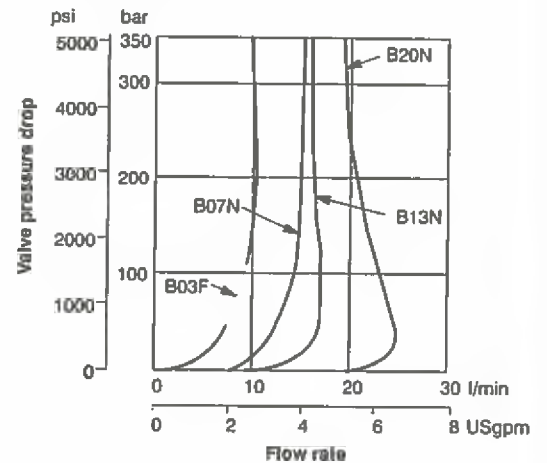
▲Curves shown are for spool types "2". These points will vary from valve to valve, but can be adjusted using the deadband-compensation feature of the drive amplifier. For spool types "33", the curves are similar, but flow starts at slightly higher command signals.

# Power Capacity Envelopes

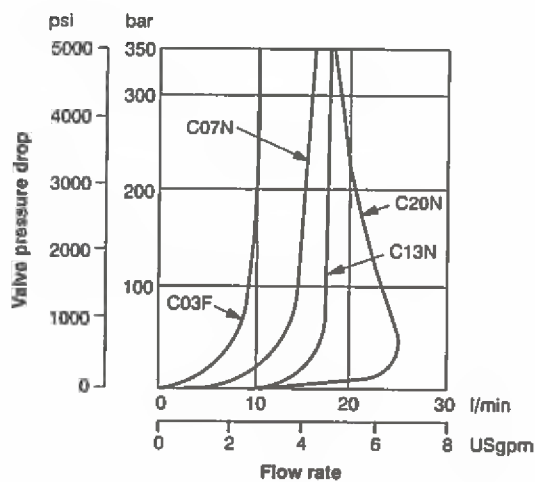
## KDG4V-3 and KTG4V-3 Looped Flow Path



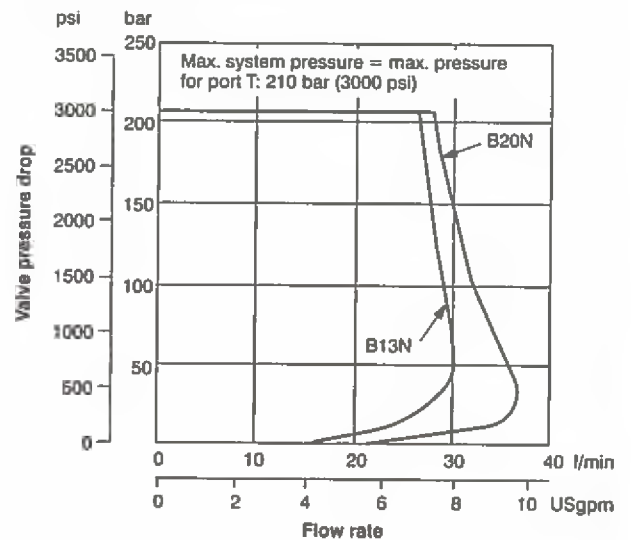
## KTG4V-3 Single Flow Path



## KDG4V-3 Single Flow Path



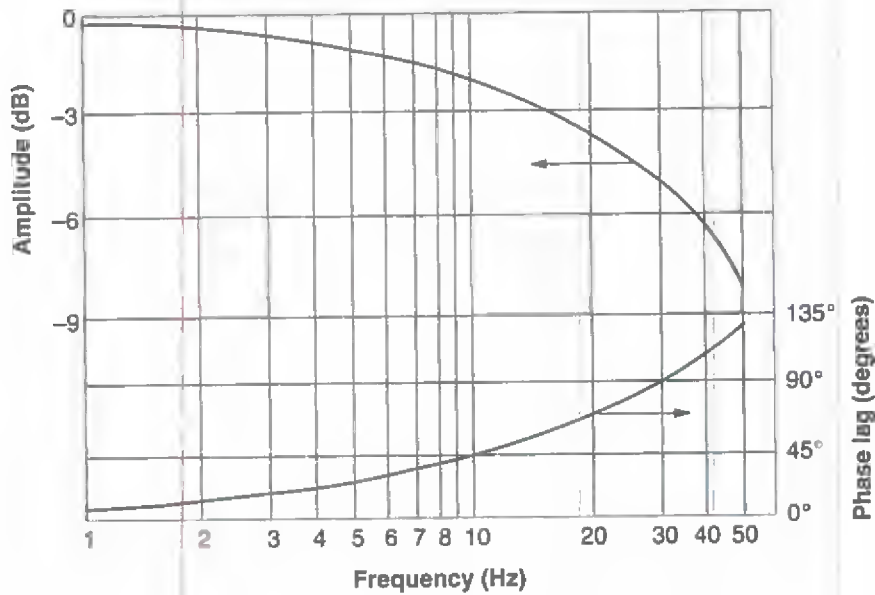
## KTG4V-3 Parallel Flow Path





# KDG4V-3 and KTG4V-3 Frequency Response

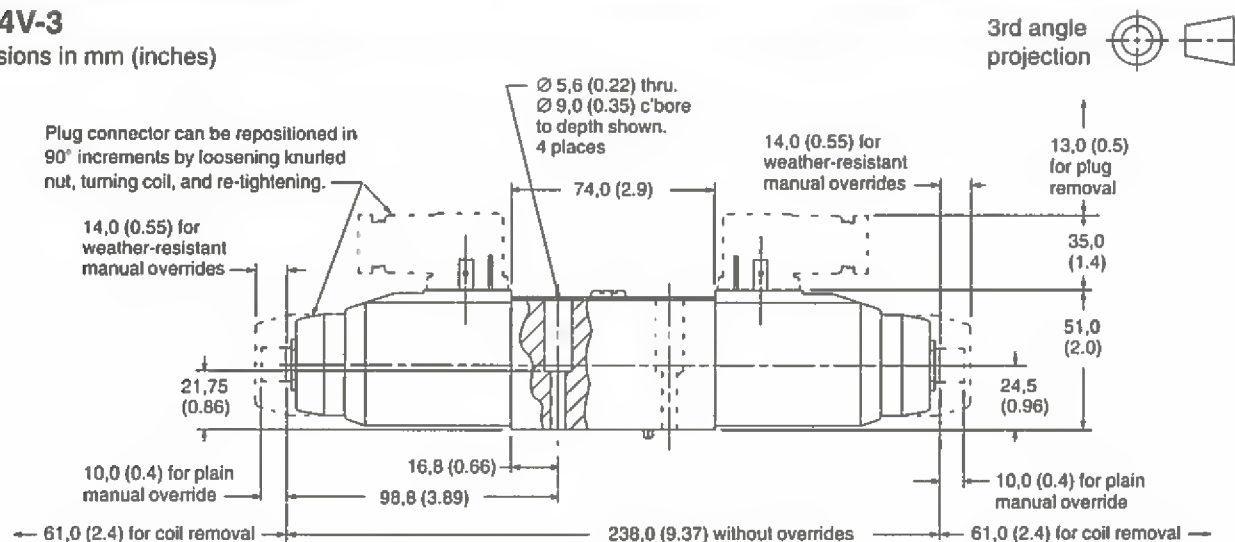
For amplitude of  $\pm 25\%$  maximum stroke about the 50% position, at  $\Delta p$  (P→B) = 5 bar (72 psi).



# KDG4V-3 and KTG4V-3 Installation Dimensions

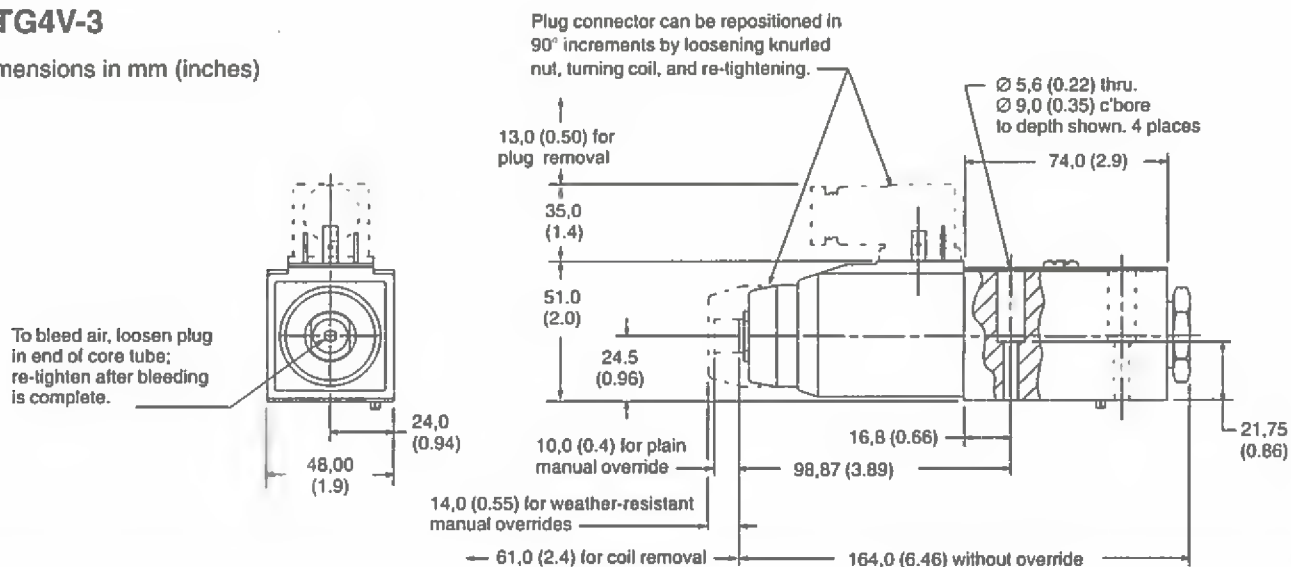
## KDG4V-3

Dimensions in mm (inches)



## KTG4V-3

Dimensions in mm (inches)



## Solenoid Plug Connectors

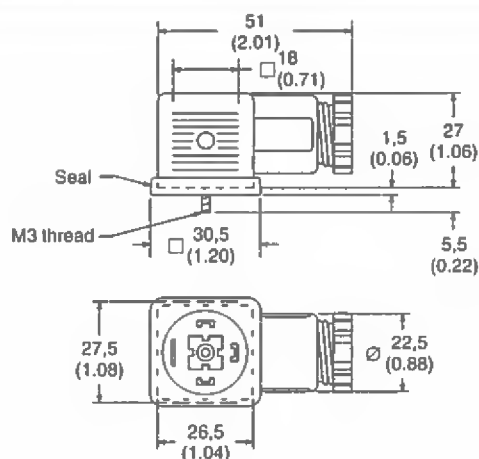
Dimensions in mm (inches)

DIN 43650 plug connector is not included with valve and must be ordered separately. For black plug marked B, order part 710775. For gray plug marked A, order part 710776.

Conductor cross-sectional area:  
0,5 to 1,5 mm<sup>2</sup> (0.0008 to 0.0023 in<sup>2</sup>)

Cable diameter range:  
6 to 10 mm (0.24 to 0.40 in)

Means of connection: screw terminals



# Mounting Requirements

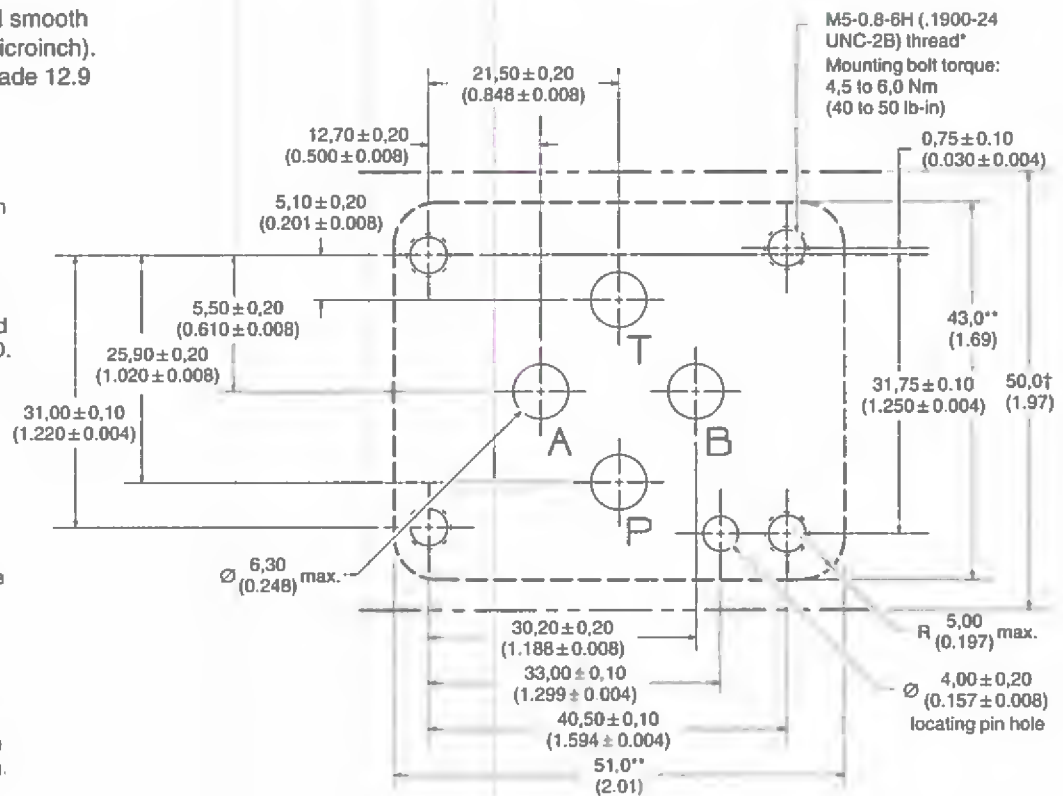
## Mounting Surface

Mounting surface must be flat within 0,013 mm (0,0005 inch) and smooth within 1,1 micrometer (45 microinch). Mounting bolts should be grade 12.9 (SAE grade 7) or better.

\* Minimum thread depth is  $1\frac{1}{2} \times$  bolt diameter (D). Recommended full thread depth is  $2 \times D + 6$  mm. This aids in interchangeability of valves and reduces number of fixing bolt lengths. Recommended engagement of fixing bolt thread for ferrous mountings is  $1\frac{1}{4} \times D$ .

\*\* Dimensions specifying area within dotted lines are minimum dimensions for mounting surface. Corners of rectangle may be radiused as shown.

† Dimension is minimum spacing distance between valve and adjacent obstructions such as wall or other valve. Dimension is also minimum distance from centerline to centerline of two similar mounting surfaces placed on manifold block. Fixing holes are at equal distances to dimension.



## Subplate and Bolt Kits

Valve subplates and mounting bolts are available and must be ordered separately.

Example:

- (1) KDG4V-3S-2C08S-M-FW-G5-60 valve
- (1) KDG4V-3S-2C08S-MU1-H5-60 valve
- (1) DGVM-3-10-S subplate
- (1) BK590716 inch mounting bolt kit
- (1) BK616452M metric mounting bolt kit

# Fluid Cleanliness

Proper fluid condition is essential for long and satisfactory life of hydraulic components and systems. Hydraulic fluid must have the correct balance of cleanliness, materials, and additives for protection against wear of components, elevated viscosity and inclusion of air.

Essential information on the correct methods for treating hydraulic fluid is included in Vickers publication 561 "Vickers Guide to Systemic Contamination Control," available from your local Vickers distributor or by contacting Vickers, Incorporated.

Recommendations on filtration and the selection of products to control fluid condition are included in 561.

Recommended cleanliness levels, using petroleum oil under common conditions, are based on the highest fluid pressure levels in the system and are coded in the chart below. Fluids other than petroleum, severe service cycles, or temperature extremes are cause for adjustment of these cleanliness codes. See Vickers publication 561 for exact details.

Vickers products, as any components, will operate with apparent satisfaction in fluids with higher cleanliness codes than those described. Other manufacturers will often recommend levels above those specified. Experience has shown, however, that life of any hydraulic component is shortened in fluids with higher cleanliness codes than those listed below. These codes have been proven to provide a long, trouble-free service life for the products shown, regardless of the manufacturer.

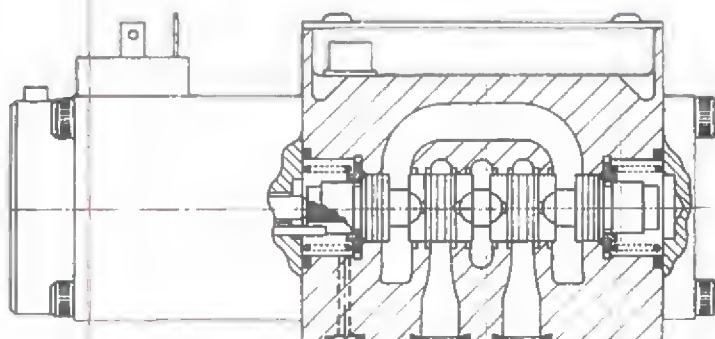
Product	System Pressure Level bar (psi)		
	<138 (<2000 )	138–207 (2000–3000)	207+ (3000+)
Vane pumps, fixed	20/18/15	19/17/14	18/16/13
Vane pumps, variable	18/16/14	17/15/13	
Piston pumps, fixed	19/17/15	18/16/14	17/15/13
Piston pumps, variable	18/16/14	17/15/13	16/14/12
Directional valves	20/18/15	20/18/15	19/17/14
<b>Proportional valves</b>	<b>18/16/13</b>	<b>18/16/13</b>	<b>17/15/12</b>
Servo valves	16/14/11	16/14/11	15/13/10
Pressure/Flow controls	19/17/14	19/17/14	19/17/14
Cylinders	20/18/15	20/18/15	20/18/15
Vane motors	20/18/15	19/17/14	18/16/13
Axial piston motors	19/17/14	18/16/13	17/15/12
Radial piston motors	20/18/14	19/17/13	18/16/13

## Proportional Directional Valves without Feedback

K(A)D/TG4V-5, 3\* Series

### Typical Section

KTG4V-5



### General Description

Vickers proportional valves shown in this catalog are designed to provide a controlled oil flow in proportion to a command signal. They are available in two types, firstly a double solenoid version that will provide reversible flow and return to an actuator, and secondly a single solenoid version that provides a single direction of flow. Hydrostats are available for load compensation and if flow enhancement is required for the single solenoid version, parallel flow path modules are available that will boost the flow capacity to nearly twice that of the standard valve.

Additionally, both of these valve types can be supplied with or without an integral amplifier built directly onto the valve.

#### KD/TG4V-5

This version is supplied without the integral amplifier.

#### Features and Benefits

- Wide range of spool and flow rate options
- Supported by amplifiers and auxiliary function modules from the Vickers range
- Electronic feedback LVDT ensures accurate speed control
- Current feedback provides inherent protection from electrical interference
- Vibration and shock tested

#### KAD/TG4V-5KAD/TG4V-5

A range of proportional directional and throttle valves with control amplifiers built directly on, and prewired to, the valves. Factory-set adjustments of gain, spool deadband compensation, dither and offset ensure high repeatability valve-to-valve.


The only electrical inputs required are power supply (24V) and a voltage command signal of  $\pm 10V$ . Electrical connections are via a standard 7-pin plug.

A monitor point allows the function of the amplifier to be checked. Ramp functions, if required, must be generated externally.

#### Features and Benefits

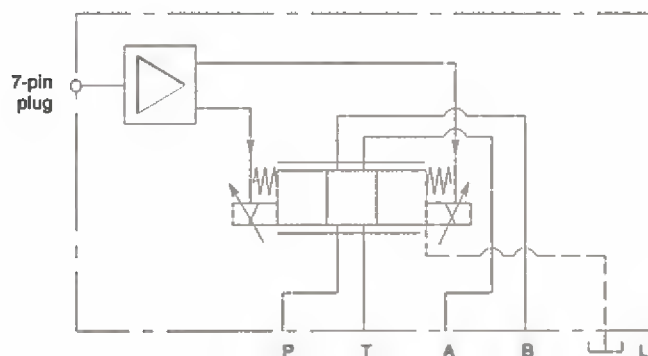
- Factory-sealed adjustments increase valve-to-valve accuracy
- Valve and amplifier selected, ordered, delivered and installed as a performance-tested package
- Standard 24V DC supply with wide tolerance band
- Standard  $\pm 10V$  DC command signals
- Installation wiring reduced and simplified
- Standard 7-pin connector
- LED status indication and monitor point help troubleshooting
- Simple valve removal and replacement for service
- Vibration and shock tested
- Supported by auxiliary function modules



This product has been designed and tested to meet specific standards outlined in the European Electromagnetic Compatibility Directive (EMC) 89/336/EEC, amended by 91/263/EEC, 92/31/EEC and 93/68/EEC, article 5. For instructions on installation requirements to achieve effective protection levels, see this leaflet, the Installation Wiring Practices for Vickers Electronic Products leaflet 2468 and leaflet 02-123931A which is packed with every KA valve. Wiring practices relevant to this Directive are indicated by  Electromagnetic Compatibility (EMC).

# Functional Symbols

## Model Types KADG4V-5



## Available Spools for K(A)DG4V-5

2C\*\*N, meter-in/meter-out



2C65S, meter-out only



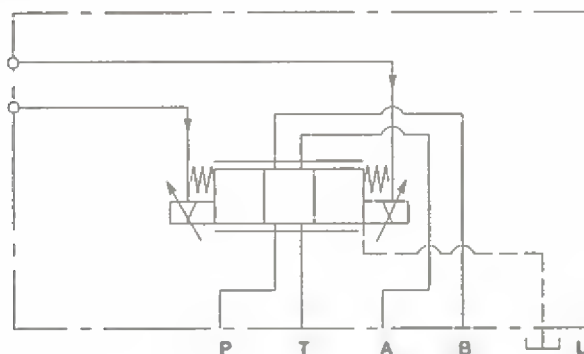
33C\*\*N, meter-in/meter-out



9C50N, zero lap, biased underlap



## Model Types KDG4V-5

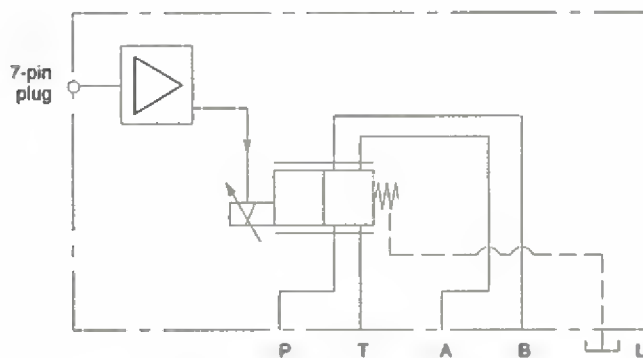


## Available Spools for K(A)TG4V-5

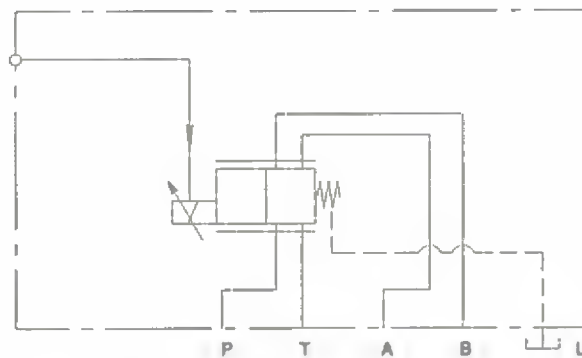
2B\*\*N, meter-in/meter-out



## Model Types KATG4V-5



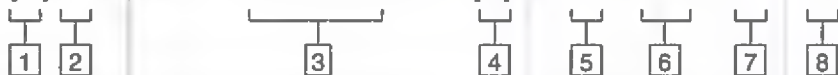
## Model Types KTG4V-5





## Model Code

K(A) \* G4V-5- \*\* \* \*\*\*\*\* -Z- (V) M- \* - \*\*\* -H \* - 3\*



### 1 Series type designator

A = Integral amplifier  
Omit for non-integral amplifier

### 2 Control type

D = Directional valve  
T = Throttle valve

### 3 Spool type

See "Functional Symbols" on previous page

### Flow rating and metering

$\Delta p = 5$  bar (72 psi) per metering flow path, e.g. B to T

### Spools for K(A)TG valves

2B30N = 30 L/min (7.9 USgpm)  
2B50N = 50 L/min (13.2 USgpm)  
2B70N = 70 L/min (18.5 USgpm)

### Symmetric spools for K(A)DG valves

2C30N = 30 L/min (7.9 USgpm)  
2C50N = 50 L/min (13.2 USgpm)  
2C65S = 65 L/min (17.2 USgpm)  
33C30N = 30 L/min (7.9 USgpm)  
33C50N = 50 L/min (13.2 USgpm)

### Asymmetric spools for K(A)DG valves

2C50N25 = 50 L/min (13.2 USgpm)  
"A" port flow  
25 L/min (6.6 USgpm)  
"B" port flow

### 4 Solenoid energization identity

V = Solenoid "A" is at port "A" end and solenoid "B" at port "B" end, independent of spool type

Blank = US ANSI B93.9 standard requiring solenoid "A" energization to connect P to A and solenoid "B" to connect P to B

### 5 Solenoid electrical connector

U = ISO 4400/DIN 43650, non-integral amplifier type only  
F = Flying lead, integral amplifier type only

### 6 Electrical connection (KA valves only)

PD7 = 7-pin connector with plastic plug  
See warning note below

### 7 Port T limit code

6 = For 2C\*\*S spools  
7 = For all other spools

### 8 Design number, 30 series

Subject to change. Installation dimensions unaltered for design numbers 30 to 39 inclusive.

### Solenoid plugs

#### KD/TG4V valves only

To be ordered separately.  
710775, for black plugs, marked B  
710776, for gray plugs, marked A



### Warning

To conform to the EC Electromagnetic Compatibility Directive (EMC) the valve with integral amplifiers must be fitted with a metal 7-pin plug. The screen of the cable must be securely connected to the shell of the metal connector. A suitable IP67 rated connector is available from Vickers, part no. 934939. This must be tightened with a torque of 2-2.5 Nm (1.5-2.0 lbf-ft) to achieve the IP67 rating. Alternatively a non IP67 rated connector is available from ITT-Cannon, part no. CA 06 COM-E 14S A7 S.

The plastic plug, part number 694534, is only suitable for use in a sealed electromagnetic environment or outside of the European Community.

## Operating Data

Performance data is typical with fluid at 36 cSt (168 SUS) and 50°C (122°F) while using the basic Vickers power amplifier.

### KD/TG4V-5 and KAD/TG4V-5 Valves

Relative duty factor	Continuous rating (ED = 100%)
Type of protection, with electrical plugs fitted correctly	IEC 144, Class IP65
Hysteresis, with flow through P-A-B-T, $\Delta p = 5$ bar (72 psi) per metering path e.g. P-A	<8% of rated flow
Step input response, with flow through P-A-B-T, $\Delta p = 5$ bar (72 psi) per metering path e.g. P-A Required flow step: 0 to 100% 100% to 0 +90 to -90% (KADG4V-5 only)	Time to reach 90% of required step: 75 ms (0.075s) 50 ms (0.050s) 80 ms (0.080s)
Mass: KDG4V-5 KADG4V-5 KTG4V-5 KATG4V-5	6,8 kg (15.00 lb) approx. 7,2 kg (15.90 lb) approx. 5,3 kg (11.70 lb) approx. 5,7 kg (12.60 lb) approx.

### KD/TG4V-5 Valves

Max. current, at 50°C (122°F) ambient: Coil type G Coil type GP Coil type H Coil type HA	3,5A 3,0A 1,6A 0,94A
Coil resistance, at 20°C (68°F): Coil type G Coil type GP Coil type H Coil type HA	1,68Ω ± 7,7Ω 23,5Ω
Coil inductance at 1000 Hz & 150 mV: Coil type G Coil type GP Coil type H Coil type HA	8 mH — 38 mH 114 mH
Repeatability, valve-to-valve	Optimized by adjustment of deadband, gain and ramp potentiometers on associated Vickers amplifier
Supporting products: Eurocard amplifier Power supply	EEA-PAM-525-* -32 EEA-PSU-704-* -20

# KAD/TG4V-5 Valves with Integral Amplifiers

Power supply	24V DC (21V to 36V including 10% peak-to-peak max. ripple) max. current 3A
Command signal Input impedance	0 to +10V DC, or 0 to -10V DC, or -10V to +10V DC 47 kΩ
7-pin plug connector Pin connections:	<div> <div>A</div> <div>B</div> <div>C</div> <div>D</div> <div>E</div> <div>F</div> <div>G</div> </div> <div> <div>Power supply +ve</div> <div>Power 0V</div> <div>Signal 0V</div> <div>+ve voltage command signal</div> <div>-ve voltage command signal</div> <div>Monitor output</div> <div>Protective ground</div> </div>
Electro-magnetic compatibility (EMC): Emission (10 v/m) Immunity (10 v/m) See "Warning" note regarding EMC on page B.50.	<div>EN 50081-2</div> <div>EN 50082-2</div>
Gain adjustment	25 to 125%
Zero adjustment	± 18%
Factory set adjustments	Deadband, gain, dither and offset
Monitor point signal Output impedance	<div>0,5V per amp solenoid current</div> <div>10 kΩ</div>
Power stage PWM frequency	2 kHz nominal
Repeatability, valve-to-valve (at factory settings): Flow gain at 100% command signal	≤ 5%
Protection: Electrical Mechanical	<div>Reverse polarity protected</div> <div>IEC 144, Class IP65</div>
Relative humidity	85 to 95% at 20 to 70°C (68 to 158°F)
Supporting products: Auxiliary electronic modules (DIN-rail mounting): EHA-CON-201-A-2* signal converter EHD-DSG-201-A-1* command signal generator EHA-RMP-201-A-2* ramp generator EHA-PID-201-A-2* PID controller Subplates, size 05 Mounting bolts Note: If not using Vickers recommended bolt kits, bolts must be to ISO 898 grade 12.9 or stronger.	



This product has been designed and tested to meet specific standards outlined in the European Electromagnetic Compatibility Directive (EMC) 89/336/EEC, amended by 91/263/EEC, 92/31/EEC and 93/68/EEC, article 5. For instructions on installation requirements to achieve effective protection levels, see this leaflet and the Installation Wiring Practices for Vickers Electronic Products leaflet 2468 and leaflet 02-123931A which is packed with every KA valve.. Wiring practices relevant to this Directive are indicated by Electromagnetic Compatibility (EMC).

## Maximum Pressures, bar (psi)

Model	Port L condition ▲	Ports P, A & B	T	L ▲
K(A)DG4V-5-**C**N-Z-(V)M-U1-HZ	Externally drained	315 (4567)	210 (3000)	10 (145)
All K(A)DG4V-5 models	Blocked by mating surface	315 (4567)	160 (2320)	160 (2320)
K(A)TG4V-5	Externally drained	315 (4567)	210 (3000)	10 (145)
	Blocked by mating surface		160 (2320)	160 (2320)

▲ If port T pressure will not exceed 160 bar (2320 psi), port L need not be connected to tank.

## Minimum Recommended Flow Rates

For spool types 2C and 33C  
 $\Delta p = 10$  bar (145 psi) for looped flow  
P-A-B-T (or P-B-A-T).

Valve size/spool code

Min. flow rate:  
L/min      in<sup>3</sup>/min

K(A)DG4V-5-\*\*C30N

1,5      91

K(A)DG4V-5-\*\*C50N

2,5      152

K(A)DG4V-5-\*\*C65S

3,0      182

## Power Capacity Envelopes

Single Solenoid Models:

K(A)TG4V-5

Spool types as noted

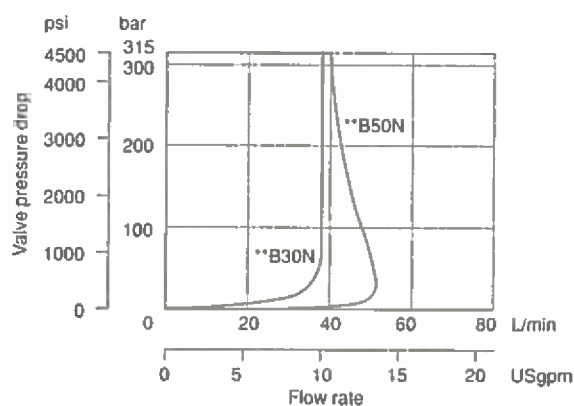
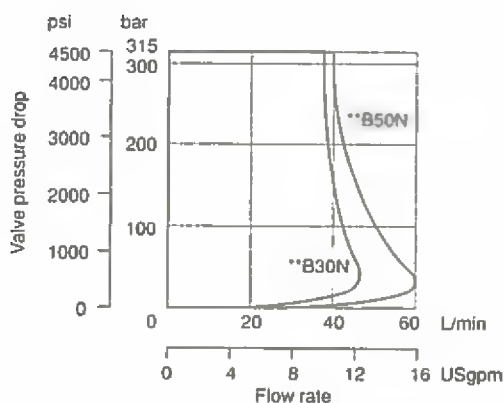
Single Flow Path

P to B



Looped Flow Path

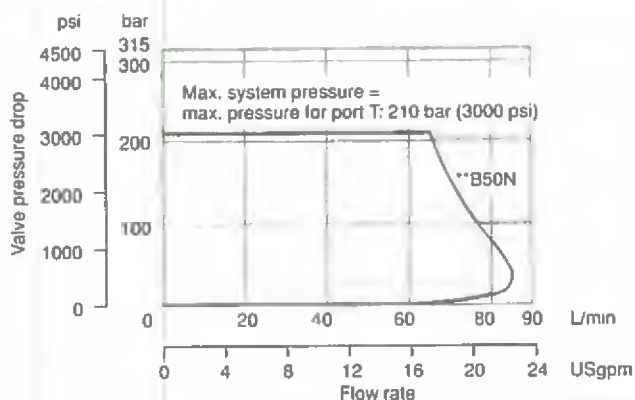
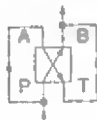
P to B plus A to T



### Single Solenoid Models: K(A)TG4V-5

#### Parallel Flow Path

P to B and A to T using  
parallel flow path module:  
KDGMA-5-616877-10R or  
KDGMA-5-02139150-10S



See catalog 2336, "Subplates and Auxiliary Connection Plates, Size 05".

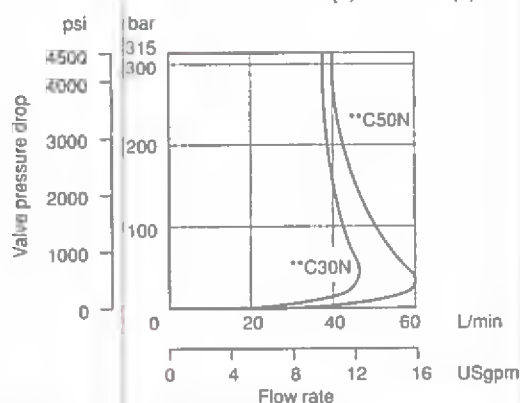
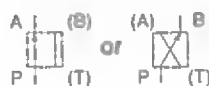
### Double Solenoid Models:

#### K(A)DG4V-5

Spool types as noted

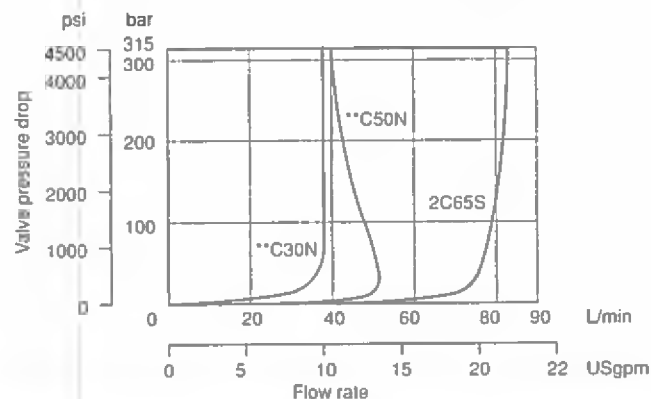
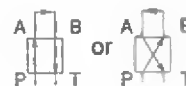
#### Single Flow Path

P to A, or P to B

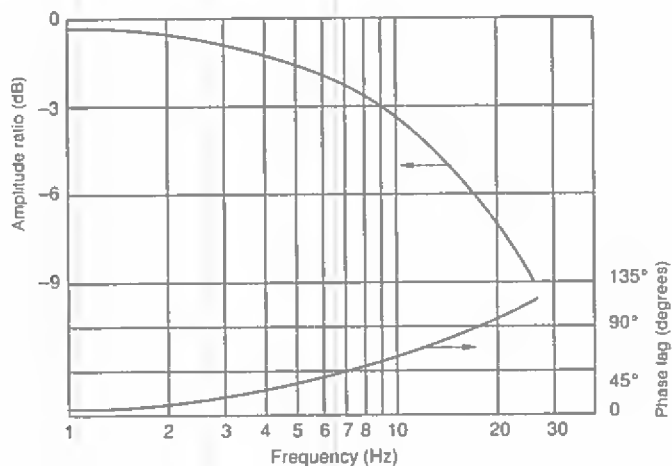


#### Looped Flow Path

P to A (or B) plus B (or A) to T



## Frequency Response

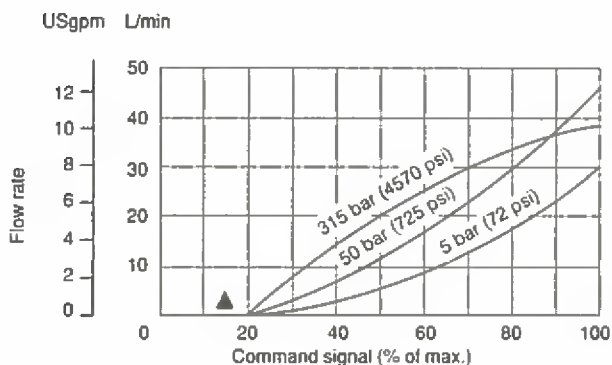


# Flow Gain Single Solenoid Models, K(A)TG4V-5

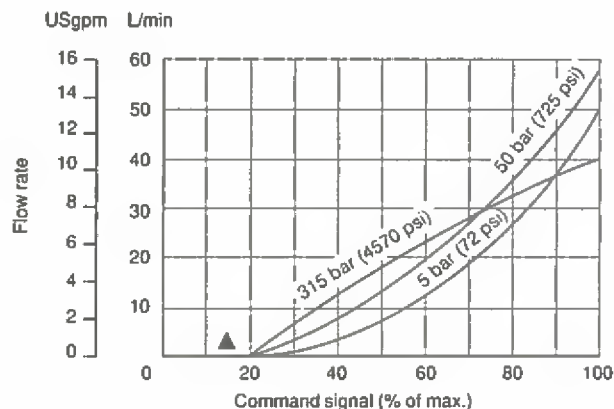
## Single Flow Path

P to B

Spool types \*\*B30N

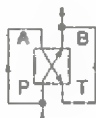


Spool types \*\*B50N



## Parallel Flow Paths

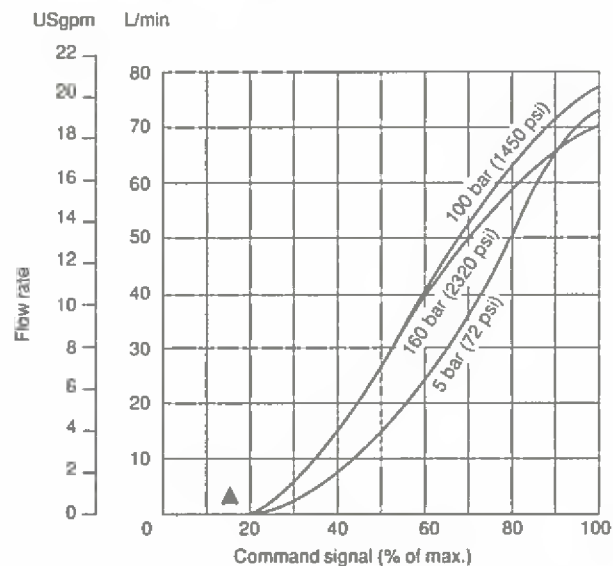
P to B and A to T using  
parallel flow path module:  
KDGMA-5-616877-10R or  
KDGMA-5-02-139150-10S



Maximum system pressures for this configuration:  
With "L" port externally drained . . . . 210 bar (3000 psi)  
With "L" port blocked . . . . . 160 bar (2320 psi)

- See catalog 2336, "Subplates and Auxiliary Connection Plates, Size 05".

Spool types \*\*B50N



- ▲ Curves shown are for spool types "2". These points will vary from valve to valve, but can be adjusted using the deadband compensation feature of the drive amplifier.  
For spool types "33" the curves are similar but flow starts at slightly higher command signals.

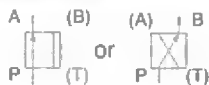


# Flow Gain

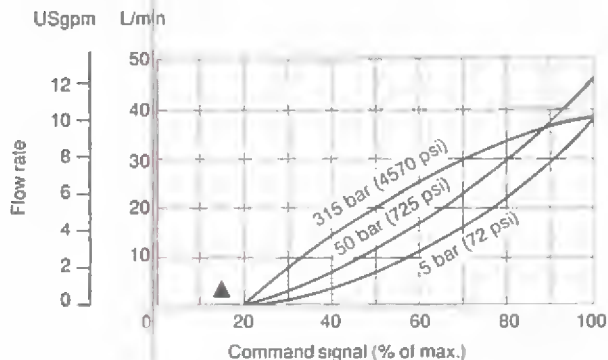
## Double Solenoid Models, K(A)DG4V-5

### Single Flow Path

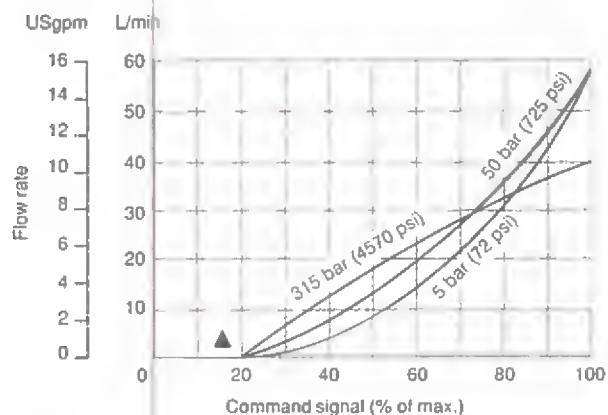
P to A, or P to B



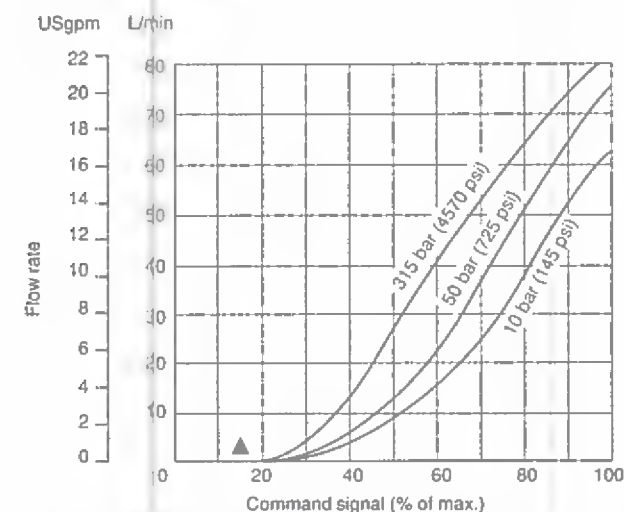
#### Spool types \*\*C30N



#### Spool types \*\*C50N

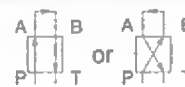


#### Spool type 2C65S

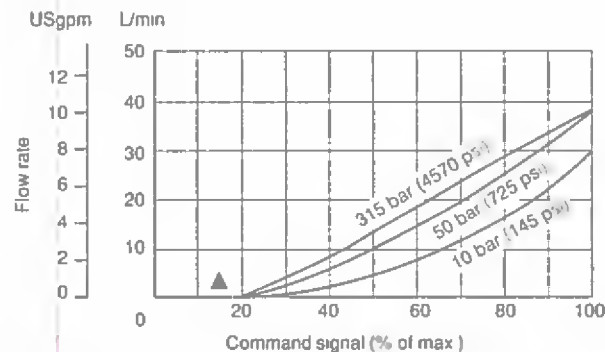


### Looped Flow Paths

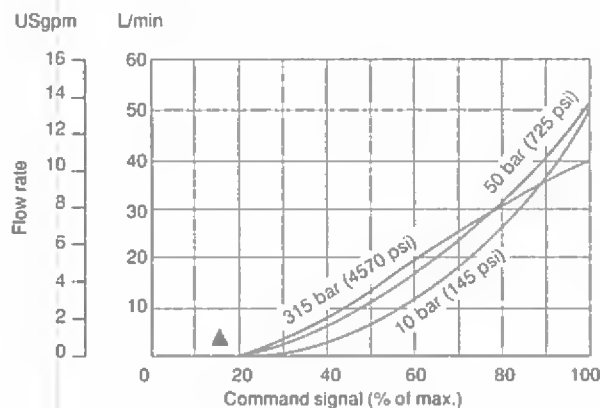
P to A (or B), plus B (or A) to T



#### Spool types \*\*C30N



#### Spool types \*\*C50N



▲ Curves shown are for spool types "2". These points will vary from valve to valve, but can be adjusted using the deadband compensation feature of the drive amplifier.  
For spool types "33" the curves are similar but flow starts at slightly higher command signals.

# Electrical Block Diagram

## Command Signals and Outputs

7-pin plug		Flow direction
Pin D	Pin E	
Positive	0V	P to A
0V	Negative	
U <sub>D</sub> - U <sub>E</sub> = Positive		
Negative	0V	P to B
0V	Positive	
U <sub>D</sub> - U <sub>E</sub> = Negative		

## KADG4V-5 and KATG4V-5

### Wiring

Connections must be made via the 7-pin plug mounted on the amplifier.  
Recommended cable sizes are:

#### Power cables:

For 24V supply

0,75 mm<sup>2</sup> (18 AWG) up to 20m (65 ft)

1,00 mm<sup>2</sup> (17 AWG) up to 40m (130 ft)

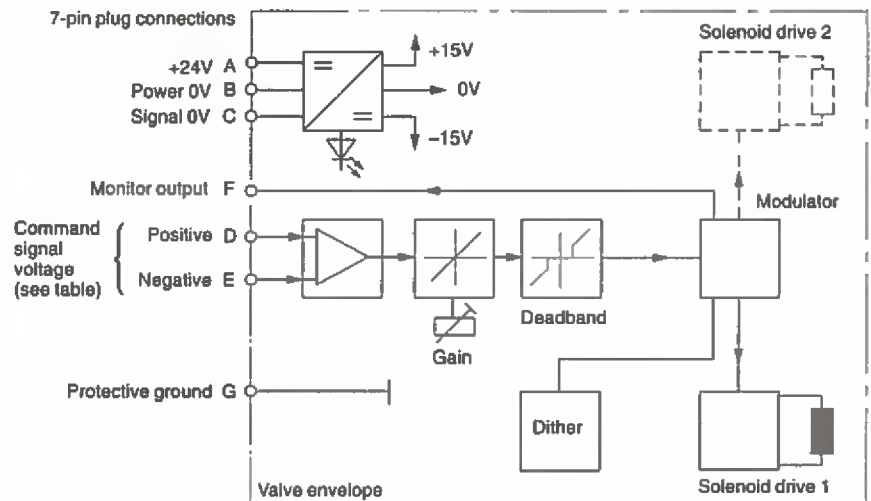
#### Signal cables:

0,50 mm<sup>2</sup> (20 AWG)

#### Screen:

A suitable cable would have 7 cores, a separate screen for the signal wires and an overall screen.

See wiring diagram on next page.

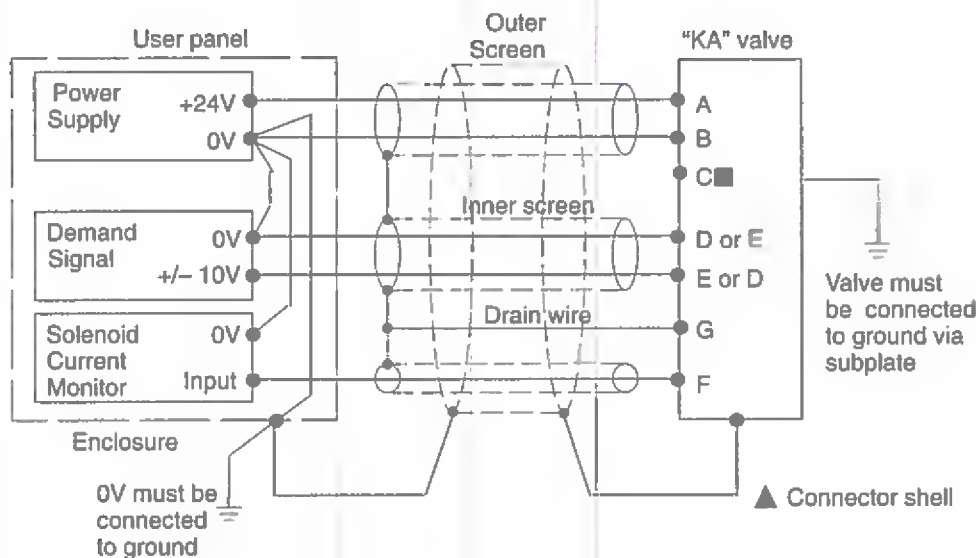


### Warning

All power must be switched off before connecting or disconnecting any plugs.

## Typical Connection Arrangements KADG4V-5 and KATG4V-5

### Wiring Connections for Valves with integral Amplifier



■ Solenoid current monitor voltage (pin F) will be referenced to the KA valve local ground. A "local ground" (pin C) is provided for optional use by differential input customer supplied electronics.



#### Warning

Do not ground pin C. If the local ground (pin C) is not used for differential monitor electronics, do not use. Read monitor pin F with respect to ground.



#### Warning

Electromagnetic Compatibility (EMC)

It is necessary to ensure that the valve is wired-up as above. For effective protection, the user electrical cabinet, the valve subplate or manifold, and the cable screens should be connected to efficient ground points. The metal 7-point connector, part no. 934939, should be used for the integral amplifier.

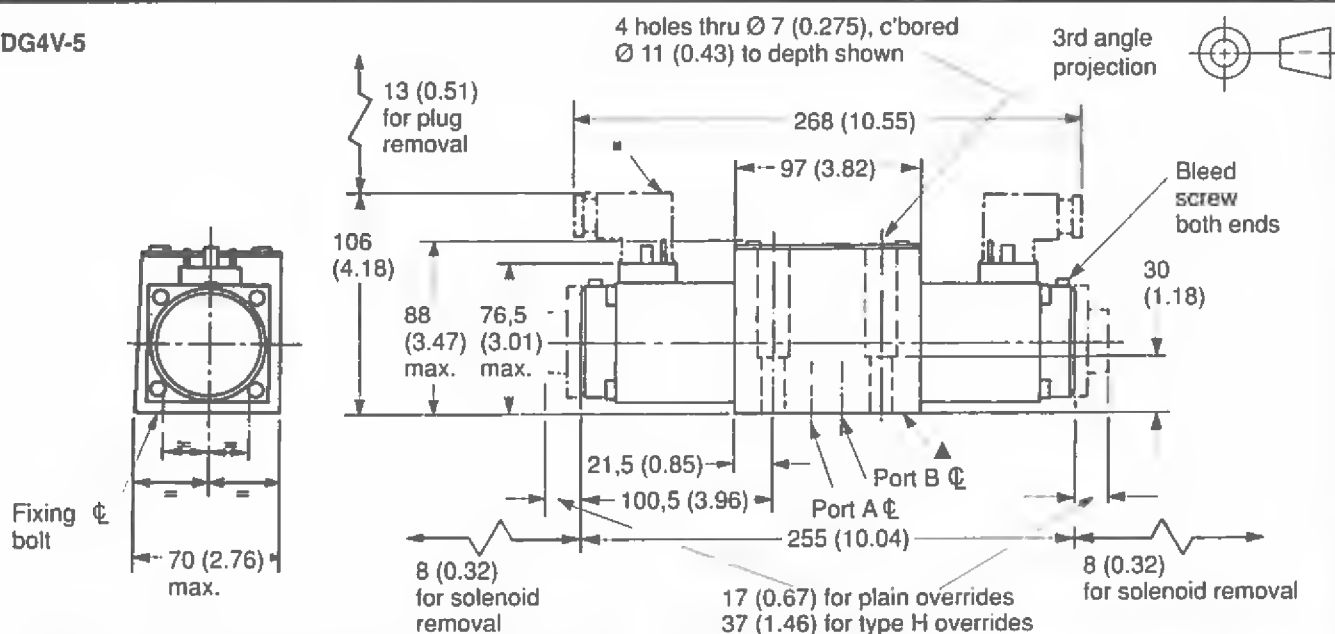
In all cases, both valve and cable should be kept as far as possible from any sources of electromagnetic radiation such as cables carrying heavy current, relays and certain kinds of portable radio transmitters, etc. Difficult environments could mean that extra screening may be necessary to avoid the interference.

It is important to connect the 0V lines as shown above. The multi-core cable should have at least two screens to separate the demand signal and monitor output from the power lines.

▲ Note: In applications where the valve must conform to European RFI/EMC regulations, the outer screen (shield) must be connected to the outer shell of the 7-pin connector and the valve body must be fastened to the earth ground. Proper earth grounding practices must be observed in this case, as any differences in command source and valve ground potentials will result in a screen (shield) ground loop.

# Installation Dimensions in mm (in)

## KDG4V-5



- Electrical plug connections (without indicator light) to ISO 4400/DIN 43650. Must be separately ordered by part number(s).

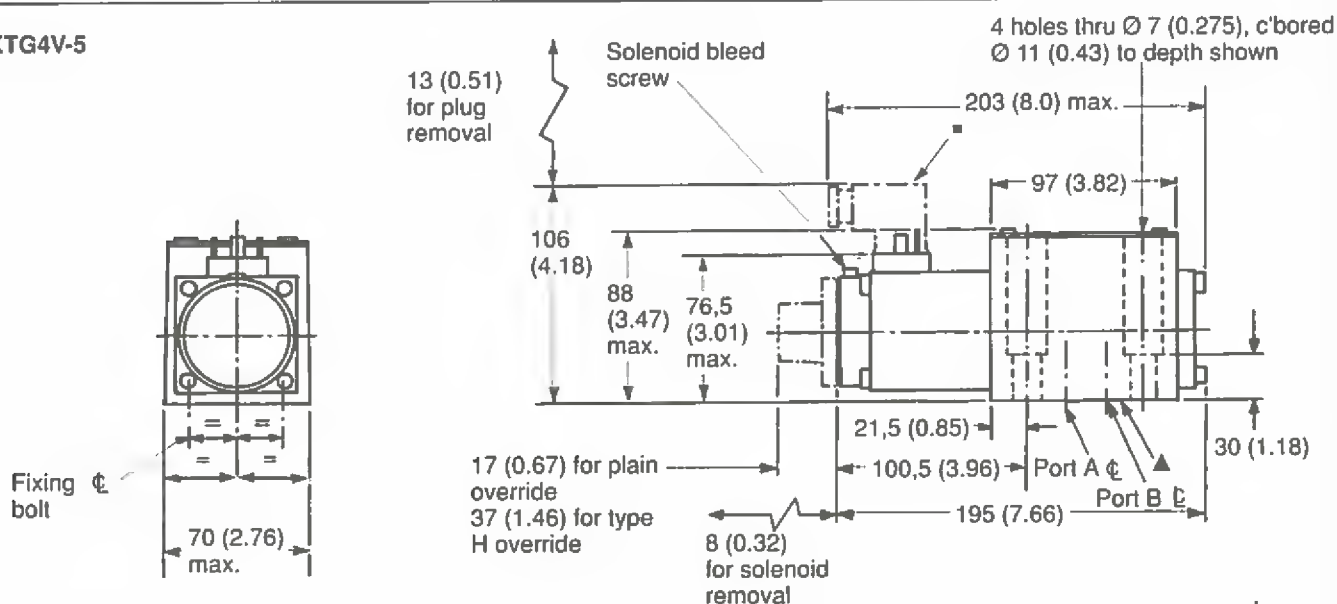
Part No	Color	Solenoid coil	Cable gland
710775	Black	Solenoid B	Pg. 11
710776	Gray	Solenoid A	Ø 6-10 (0.23-0.39 dia)

### Solenoid and plug identities

At port "A" end	At port "B" end	For
A	B	KDG4V-5-C***(-)-VM
B	A	KDG4V-5-C***(-)-M

The cable entry can be repositioned at 90° intervals from the position shown. This is done by re-assembling the contact holder into the appropriate position inside the plug connector housing.

## KTG4V-5



- Electrical plug connections (without indicator light) to ISO 4400/DIN 43650. Must be separately ordered by part number(s).

Part No	Color	Solenoid coil	Cable gland	For valve
710775	Black	Solenoid B	Pg. 11	KTG4V-5-B***(-)-M
710776	Gray	Solenoid A	Ø 6-10 (0.23-0.39 dia)	KTG4V-5-B***(-)-VM

The cable entry can be repositioned at 90° intervals from the position shown. This is done by re-assembling the contact holder into the appropriate position inside the plug connector housing.

▲ Mounting surface, seals supplied.  
For mating surface dimensions and subplate options, see catalog 2336.  
For mounting bolt kit options see catalog 2314.

## Installation Dimensions in mm (in)

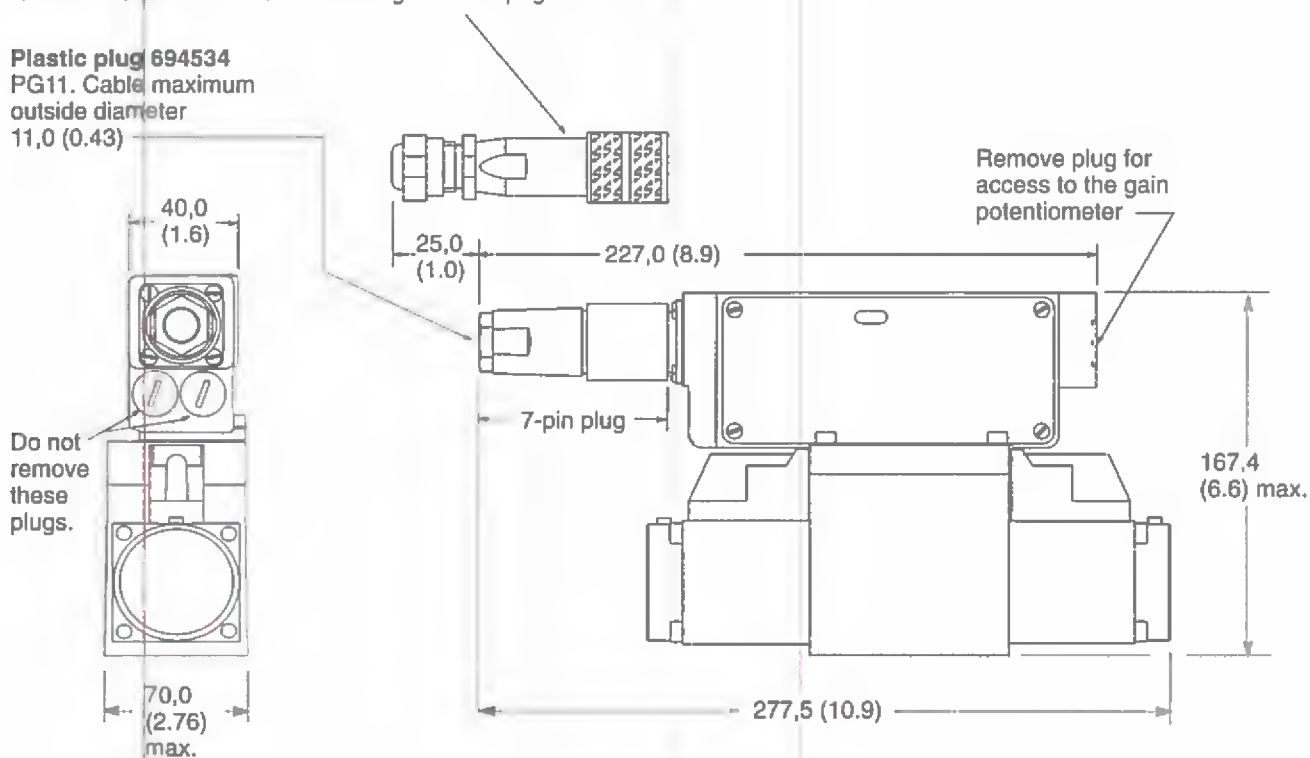
### KADG4V-5

#### Metal plug 934939

Cable outside diameter 8,0 to 10,5 (0.31 to 0.41) Must be used for full EMC protection. See "Warning" note on page B.50

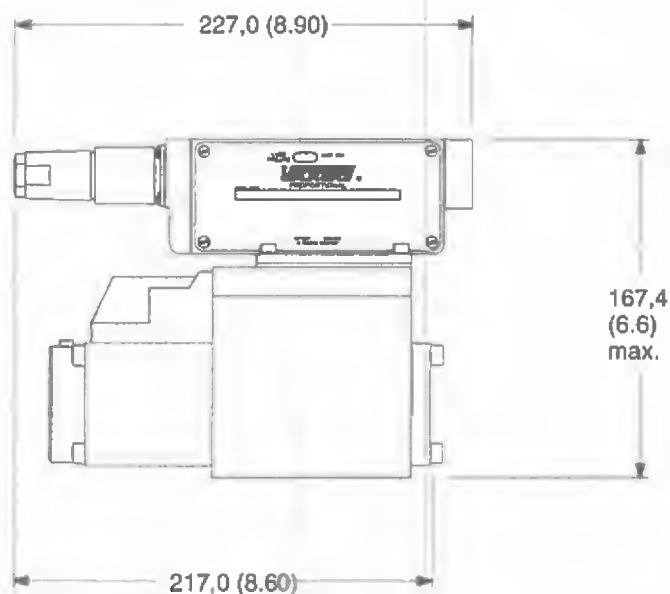
#### Plastic plug 694534

PG11. Cable maximum outside diameter 11,0 (0.43)



See "Warning" note on page B.42 regarding the use of 7-pin plugs.

### KATG4V-5



## Further Information

### Hydraulic Fluids

Materials and seals used in these valves are compatible with:

Anti-wear petroleum oils ..... L-HM

Non-alkyl based

phosphate esters ..... L-HFD

The extreme operating range is 500 to 13 cSt (270 to 70 SUS) but the recommended running range is 54 to 13 cSt (245 to 70 SUS). For further technical information about fluids see Technical Information leaflet B-920 or I-286-S.

### Contamination Control Requirements

Recommendations on contamination control methods and the selection of products to control fluid condition are included in Vickers publication 9132 or 561, "Vickers Guide to Systemic Contamination Control". The book also includes information on the Vickers concept of "ProActive Maintenance".

The following recommendations are based on ISO cleanliness levels at 2 µm, 5 µm and 15 µm.

For products in this catalog the recommended levels are:

Up to 210 bar (3050 bar) .... 18/16/13

Above 210 bar (3050 bar) ... 17/15/12

### Installation and Start-up Guidelines

The proportional valves in this catalog can be mounted in any attitude but it may be necessary, in certain demanding applications, to ensure that the solenoids are kept full of hydraulic fluid. If this proves to be the case any accumulated air can be bled from the solenoid bleed screws. This task is easier if the valve has been mounted base downwards. Good installation practice dictates that the tank port, and any drain port, are piped so as to keep the valve full of fluid once the system start-up has been completed.

### Temperatures

For petroleum oil:

Min. .... -20°C (-4°F)

Max.\* ..... +70°C (158°F)

\* To obtain optimum service life from both fluid and hydraulic system, 65° C (150° F) normally is the maximum temperature.

For other fluids where limits are outside those of petroleum oil, consult fluid manufacturer or Vickers representative. Whatever the actual temperature range, ensure that viscosities stay within those specified under "Hydraulic Fluids".

Ambient for:

Valves, including any feedback transducers and integral amplifiers at full performance specification: -20 to +60°C (-4 to +140°F).

Valves, as above, will operate at temperatures of 0 to -20°C (32 to -4°F) but with a reduced dynamic response.

Storage:

-25 to +85°C (-13 to +185°F)

Eurocard electronics:

0 to 50°C (32 to 122°F)

### Service Information

The products from this range are preset at the factory for optimum performance, disassembling critical items would destroy those settings. It is therefore recommended that should any mechanical or electronic repair be necessary they should be returned to the nearest Vickers repair center. The products will be refurbished as necessary and retested to specification before return to you.

Field repair is restricted to the replacement of the listed parts below.

Seal kit (KD/TG) ..... 565110

Seal kit (KAD/TG) ..... 02-139127

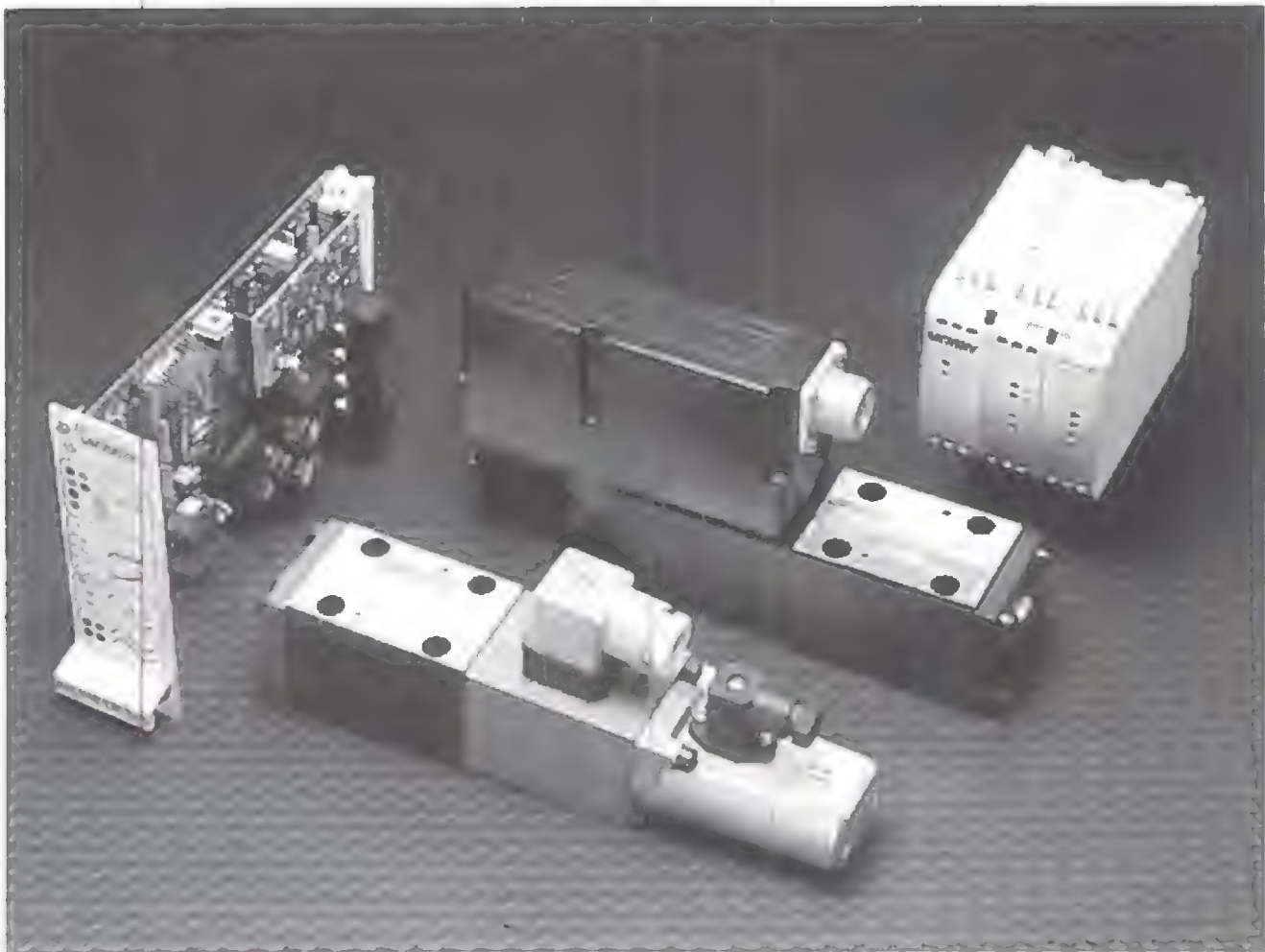





# Proportional Directional Valves with Feedback

K(B)FD/TG4V-3, 1\*/2\* Series

Pressures to 350 bar (5000 psi)



*This product has been designed and tested to meet specific standards outlined in the European Electromagnetic Compatibility Directive (EMC) 89/336/EEC, amended by 91/263/EEC, 92/31/EEC and 93/68/EEC, article 5. For instructions on installation requirements to achieve effective protection levels, see this leaflet and the Installation Wiring Practices for Vickers Electronic Products leaflet 2468. Wiring practices relevant to this Directive are indicated by  Electromagnetic Compatibility (EMC).*

5071.00/EN/1097/A

# Introduction

## General Description

Vickers proportional valves shown in this catalog are designed to provide a controlled oil flow in direct proportion to a command signal. They are available in two types; a double solenoid version that will provide reversible flow to an actuator and a single solenoid throttle version that provides a single direction of flow. Hydrostats are available for load compensation and parallel flow path modules are available that will boost the flow capacity of single solenoid throttle versions to nearly twice that of the standard valve.

Additionally, both of these valve types can be supplied with or without an integral amplifier built directly onto the valve.

### KFD/TG4V-3

This version is supplied **without** the integral amplifier.

#### Features and Benefits

- Wide range of spool and flow rate options.
- Electronic feedback LVDT ensures accurate spool position control.
- Internal current feedback provides optimal control.

- Vibration and shock tested.
- Supported by a broad range of amplifiers and auxiliary function modules.
- Full CE electromagnetic compatibility.

### KBFD/TG4V-3

A range of proportional directional and throttle valves **with** integral control electronics. Factory-set adjustments of gain, spool deadband compensation and offset ensure consistent repeatability valve-to-valve.

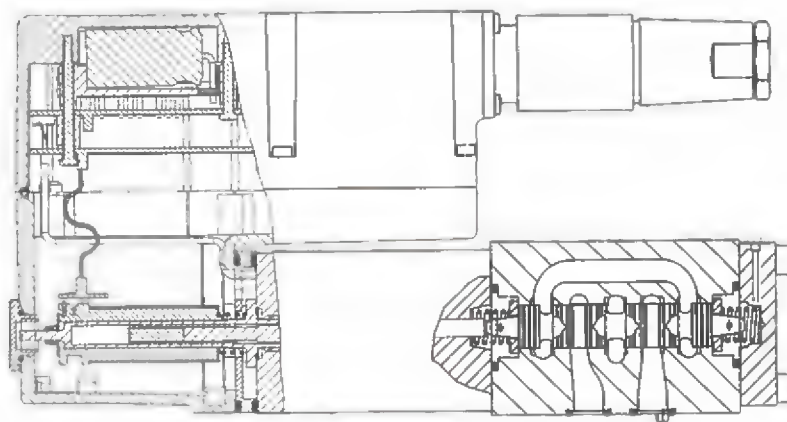
The only electrical inputs required are power supply (24V) and a voltage command signal of  $\pm 10V$ . The amplifier is housed in a robust metal enclosure, sealed against ingress of water and other fluids. Electrical connections are via a standard 7-pin plug.

A spool position monitor pin allows the function of the valve to be electrically monitored. Ramp functions, if required, can be generated externally.

## Features and Benefits

- Factory-sealed adjustments ensure valve-to-valve reproducibility
- Installation wiring reduced and simplified.
- Standard 7-pin connector.
- Standard 24V DC supply with wide tolerance band.
- Standard  $\pm 10V$  DC command signals.
- Valve with integrated amplifier selected, ordered, delivered and installed as one performance-tested package.
- Spool position monitor pin to help with troubleshooting.
- Simple valve removal and replacement for service (plug & play).
- Vibration and shock tested.
- Auxiliary DIN rail mounted electronic function modules available.
- Full CE electromagnetic compatibility.
- IP67 valve environmental protection rating.
- Optional valve enable function.

## Typical Section View



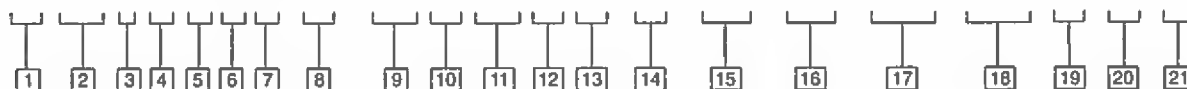
KBFD/TG4V-3-\*C, 1\* Design

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# Model Code

K (B)F \* G4 V -3 - \*\* \* \*\* \* \*\* - Z - (V) - (M) - (U1) - (\*\*\*) - H - \* - \*



## 1 Valve type

K – Proportional valve

## 2 Integral amplifier

B – Integral amplifier "B" series  
Omit for models *without* integral amplifier

## 3 Feedback arrangement

F – Spool position

## 4 Control type

D – Directional valve  
T – Throttle valve

## 5 Mounting

G – Subplate mounted

## 6 Operation

4 – Solenoid operated

## 7 Pressure rating

V – 350 bar (5000 psi) on ports  
P, A, & B

## 8 Interface

3 – ISO 4401, size 03-02-0-94  
ANSI/B93.7M-D03

## 9 Spool type (center condition) (see spool data, page B.58)

2 – Closed center (all ports)  
33 – P port closed, bleed A & B to T

## 10 Spool/spring arrangement

B – Spring centered single solenoid valve  
(solenoid "B" only) Solenoid "A" for  
"V" version  
C – Spring centered, dual solenoid

## 11 Spool flow rating

$\Delta p = 5$  bar (75 psi) per metering flow  
path, e.g. B to T. For actual maximum  
flow refer to power capacity envelope  
curves page B.61).

03 – 3 L/min (0.79 USgpm)  $\Delta$   
07 – 7 L/min (1.85 USgpm)  $\blacktriangle$   
13 – 13 L/min (3.43 USgpm)  $\blacktriangle$   
20 – 20 L/min (5.28 USgpm)  $\blacktriangle$   
28 – 28 L/min (7.40 USgpm)  $\square$

$\blacktriangle$  Meter-in/meter-out

$\square$  Meter-out only; type 2  
spool only

$\Delta$  Fine meter-in/meter-out

## 12 Spool metering type

N – Meter-in and meter-out  
F – Fine meter-in and meter-out  
S – Meter-out only

## 13 Flow rating ("B" port flow for asymmetric spools) K(B)FDG valves only

10 – 10 L/min (2.64 USgpm)  
(20N10 only)

Omit for symmetrical spools

## 14 Manual overrides

Z– No manual overrides

## 15 Solenoid energization identity

(non-integral amplifier types only, omit for  
valves with integral amplifier)

V – Solenoid "A" is at port "A" end and  
Solenoid "B" is at port "B" end  
independent of spool type

Blank US ANSI B93.9 standard  
(energize solenoid "A", flow  
symbol is (P→A))

## 16 LVDT plug

(omit for valves with integral amplifier)  
M – Standard LVDT (mating plug  
supplied)

## 17 Solenoid connector

(omit for valves with integral amplifier)  
U1 – ISO 4400/DIN 43650,  
non-integral amplifier type only  
(mating plug supplied)

## 18 Electrical connection (KBF valves only)

PC7 – 7 pin connector without plug  
PE7 – 7 pin electrical plug with mating  
half  
PH7 – As PE7 but with pin "C" used for  
enable signal  
PR7 – As PC7 but with pin "C" used  
for enable signal

## 19 Coil rating

H – 24 VDC amplifier supply

## 20 Port T pressure limit code

6 – for 2C\*\*S spools  
7 – for all other spools

## 21 Design number

1\* and 2\* series. Subject to change



### Warning

Valves with integral  
amplifiers are supplied with  
or without the metal 7-pin plug. The  
Vickers plug, part no. 934939, must be  
correctly fitted to ensure that the EMC  
rating and IP67 rating are achieved. The  
plug retaining nut must be tightened  
with a torque of 2-2,5 Nm (1.5-2.0 lbf ft)  
to effect a proper seal)

# Spool Data

## Spool Symbols

### Available Spools for K(B)FDG4V-3

Spool type 2C\*\*\*N, meter-in/meter-out



Spool type 2C20N10, assymetric flow



Spool Type 2C28S, meter-out only



Spool type 33C\*\*\*N, meter-in/meter-out



Spool type 33C20N10, assymetric flow



### Available Spools for K(B)FTG4V-3

Spool type 2B\*\*\*N, meter-in/meter-out



## Spool Types and Flow Ratings

### Symmetric Spools

Base line starting at  $\Delta p = 5$  bar (75 psi) per metering flow path, e.g. B to T. For actual maximum flow refer to power capacity envelope curves.

Spool code	Spool symbol	Flow rating
For K(B)FDG4V-3 valves:		
2C03F	2C	3 L/min (0.79 USgpm)
2C07N	2C	7 L/min (1.85 USgpm)
2C13N	2C	13 L/min (3.43 USgpm)
2C20N	2C	20 L/min (5.28 USgpm)
2C28S	2C	28 L/min (7.40 USgpm)
33C03F	33C	3 L/min (0.79 USgpm)
33C07N	33C	7 L/min (1.85 USgpm)
33C13N	33C	13 L/min (3.43 USgpm)
33C20N	33C	20 L/min (5.28 USgpm)
For K(B)FTG4V-3 valves:		
2B03F	2B	03 L/min (0.79 USgpm)
2B07N	2B	07 L/min (1.85 USgpm)
2B13N	2B	13 L/min (3.43 USgpm)
2B20N	2B	20 L/min (5.28 USgpm)

### Asymmetric Spools

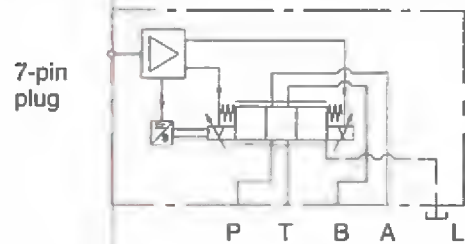
Figure preceding metering type designator, "N" (e.g. 2C\*\*\*N) is flow rating P-A, or A-T ("A" port flow); figure after "N" (N\*\*\*) is flow rating P-B, or B-T ("B" port flow).

Spool code	Spool symbol	Flow rating
For K(B)FDG4V-3 valves:		
2C20N10	2C	20 L/min (5.28 USgpm), "A" port flow 10 L/min (2.64 USgpm), "B" port flow
33C20N10	33C	20 L/min (5.28 USgpm), "A" port flow 10 L/min (2.64 USgpm), "B" port flow

## Functional Symbols

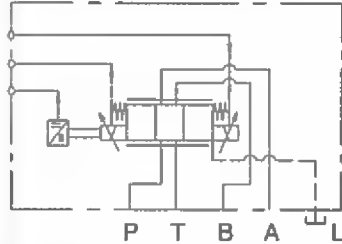
### Model Types KBFDG4V-3

proportional directional valve (with integrated electronics)



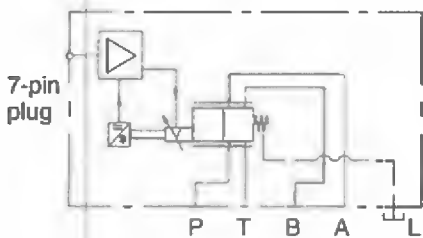
### Model Types KFDG4V-3

proportional directional valve (requires amplifier card)



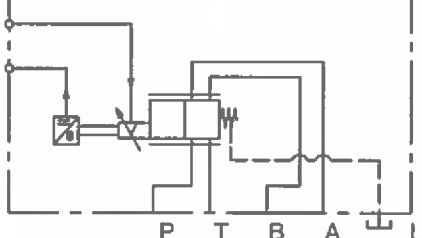
### Model Types KBFTG4V-3

proportional throttle valve (with integrated electronics)



### Model Types KFTG4V-3

proportional throttle valve (requires amplifier card)

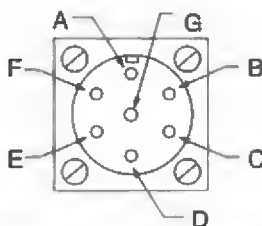




# Operating Data

## Valves w/amplifier

**KBFD/TG4V-3 Valves with integral amplifier.** Data is typical with fluid at 36 cSt (168 SUS) and 50°C (122°F).

Power supply	24V DC (21V to 36V including 10% peak-to-peak max. ripple) max current 3A																		
Command signal Input impedance Common mode voltage to pin B	0 to +10V DC, or 0 to -10V DC, or -10 V to +10 V DC 47 kΩ 18V (max)																		
Valve enable signal for model codes PH7 & PR7 Enable Disable Input impedance	>8.5V (36V max) <6.5V 10 kΩ																		
7-pin plug connector   <p>View of pins of fixed half</p>	<table> <tr> <th>Pin</th><th>Description</th></tr> <tr> <td>A</td><td>Power supply positive (+)</td></tr> <tr> <td>B</td><td>Power 0V</td></tr> <tr> <td>C</td><td>Command/Monitor 0V (PE7 &amp; PC7)</td></tr> <tr> <td>D</td><td>Valve enable (PH7 &amp; PR7)</td></tr> <tr> <td>E</td><td>Command signal (+)—non-inverting input</td></tr> <tr> <td>F</td><td>Command signal (—)—inverting input</td></tr> <tr> <td>G</td><td>Monitor input</td></tr> <tr> <td></td><td>Protective ground</td></tr> </table>	Pin	Description	A	Power supply positive (+)	B	Power 0V	C	Command/Monitor 0V (PE7 & PC7)	D	Valve enable (PH7 & PR7)	E	Command signal (+)—non-inverting input	F	Command signal (—)—inverting input	G	Monitor input		Protective ground
Pin	Description																		
A	Power supply positive (+)																		
B	Power 0V																		
C	Command/Monitor 0V (PE7 & PC7)																		
D	Valve enable (PH7 & PR7)																		
E	Command signal (+)—non-inverting input																		
F	Command signal (—)—inverting input																		
G	Monitor input																		
	Protective ground																		
Electromagnetic compatibility (EMC): Emission (10 V/m) Immunity (10 V/m)	EN 50081-2 EN 50082-2																		
Threshold command voltage (minimum voltage for minimum flow)	0.25V																		
Monitor signal (pin F)      KBFD valves KBFT valves	± 10V DC for full spool stroke 0 to -10V DC for full spool stroke																		
Output impedance	10kΩ																		
Power stage PWM frequency	10 kHz nominal																		
Step input response with flow through P-A-B-T Δp=5 bar (75psi) per metering path, e.g. P-A Required flow step: 0-100% 100% - 0 +90 - -90% (KBFDG4V-3 only)	Time to reach 90% of required step: 15 ms 15 ms 22 ms																		
Reproducibility, valve-to-valve (at factory settings): Flow at 100% command signal	≤ 5%																		
Protection: Electrical Environmental	Reverse polarity protected IEC 144, Class IP67																		
Ambient air temperature range for full performance Oil temperature range for full performance	0° C to 70° C (32° F to 158° F) 0° C to 70° C (32° F to 158° F)																		
Minimum temperature at which valves will work at reduced performance	-20° C (-4° F)																		
Storage temperature range	-25° C to +85° C (-13° F to +185° F)																		
Supporting products: Auxiliary electronic modules (DIN -rail mounting): EHA-CON-201-A2* signal converter EHD-DSG-201-A-1* command signal generator EHA-RMP-201-A-2* Ramp generator EHA-PID-201-A-2* PID controller EHA-PSU-201-A-10 Power supply	See catalog GB 2410A See catalog GB 2470 See catalog GB 2410A See catalog GB 2427 See catalog GB 2410A																		



# Operating Data

## Valves w/o amplifier

### KFD/TG4V-3 Valves without Integral amplifier (requires a Eurocard amplifier, refer to Supporting Products)

Max current, at 50° C (122° F) ambient	2,7 A
Coil resistance, at 20° C (68° F)	1,87Ω
Step response: Step size (% of max spool stroke): 0 to 100% 100% to 0 +90 to -90% (KFDG4V-3 only)	Time to reach 90% of required step: 18 ms 19 ms 30 ms
Type of protection, with electrical plugs fitted correctly	IEC 144, Class IP67
Electromagnetic compatibility (EMC) Emission (10 V/m) Immunity (10 V/m)	EN 50081-2 EN 50082-2
Maximum allowable ambient air temperature	60° C (140° F)
Maximum allowable oil temperature	60° C (140° F)
Supporting products: Eurocard amplifiers EBA PAM 533 A/B/C/D/E/F	See catalog GB 2464

### KFD/TG4V-3 and KBFD/TG4V-3 Valves (all valves)

Relative duty factor	Continuous rating (ED = 100%)
Hysteresis with flow through P-A-B-T	< 1% of max stroke (center-to-offset)
Mass: KFDG4V-3 KBFDG4V-3 KFTG4V-3 KBFTG4V-3	2,7 kg (5.9 lb) approx. 3,1 kg (6.8 lb) approx. 2,1 kg (4.6 lb) approx. 2,5 kg (5.5 lb) approx.
Portable test equipment EHA TEQ 700 A 20 EBA TEQ 706 A 10	See catalog GB 2462 See catalog GB 2315

## Pressures and Flow Rates

### Maximum pressures, bar (psi)

Model	Port L condition	Ports P, A, B	T	L
All models for normal usage (L port not connected)	Normally blocked by mounting surface	315 (4500)	160 (2300)	160 (2300)
		350 (5000)	105 (1500)	105 (1500)
For K(B)FDG4V-3-**C**N/E-Z models only, a higher "T" port pressure is allowed if the "L" port is connected directly to tank	Drained directly to tank	350 (5000)	210 (3000)	10 (150)

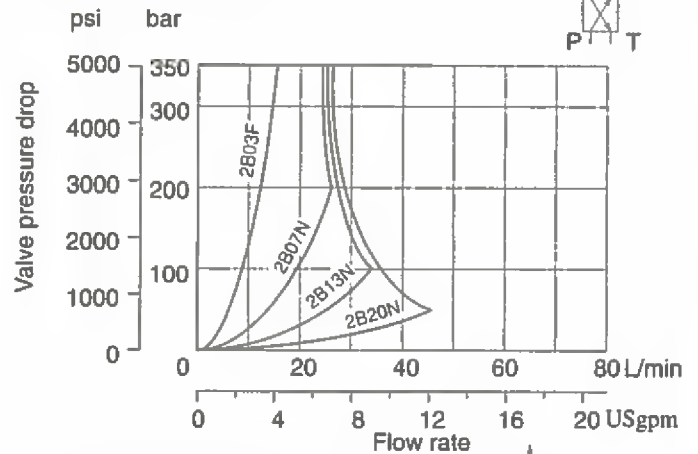
# Performance Curves

## Power Capacity Envelopes

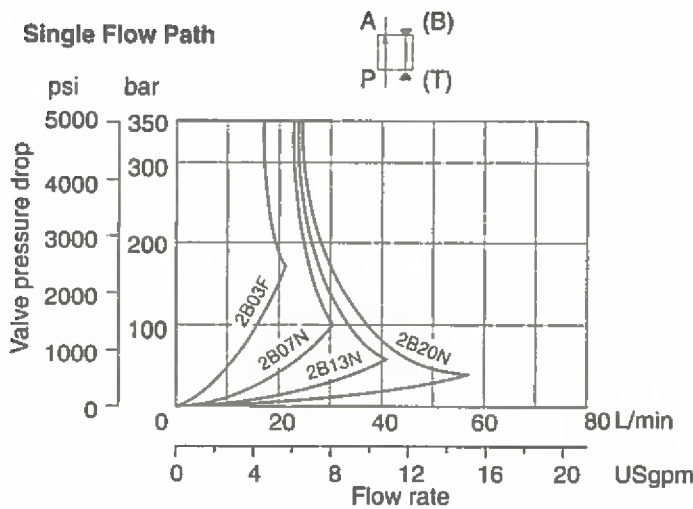
Single solenoid models: K(B)FTG4V-3  
Spool types as noted

Subject to maximum pressure limitations according to model type.  
See "Maximum Pressures" on page B.60.

### Looped Flow Path

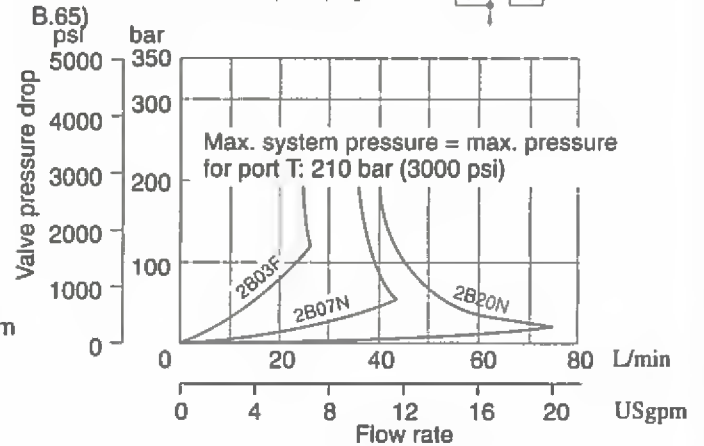


### Single Flow Path



### Parallel Flow Path

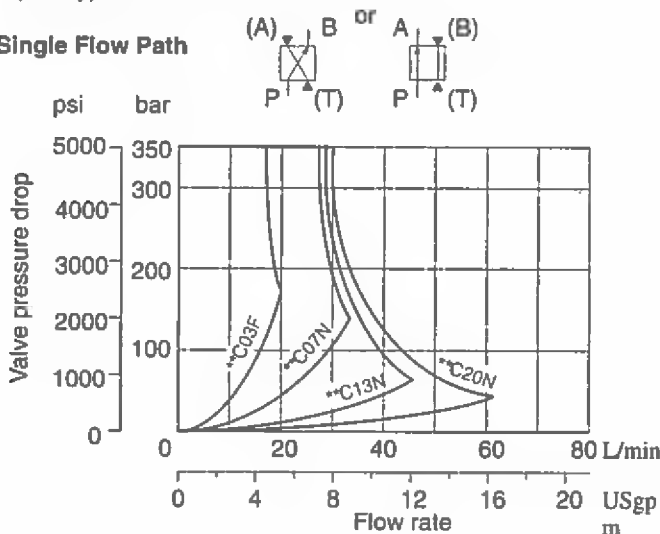
Use parallel flow path module  
KDGMA-3-616265-10 (see page B.65)



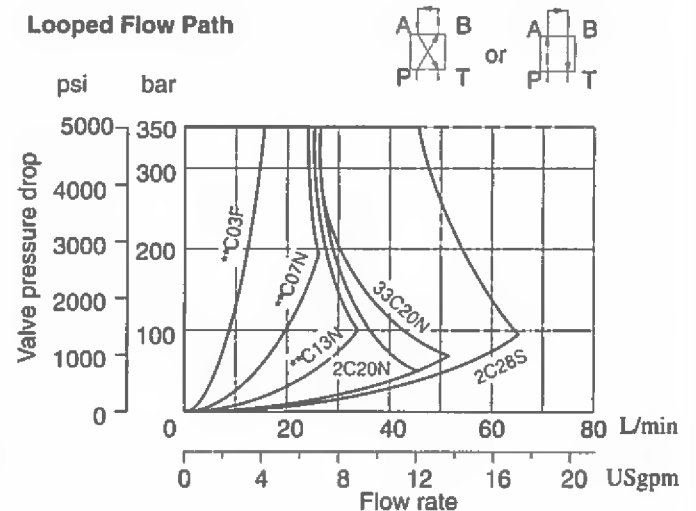
## Double Solenoid Models: K(B)FDG4V-3

Spool types as noted

### Single Flow Path



### Looped Flow Path

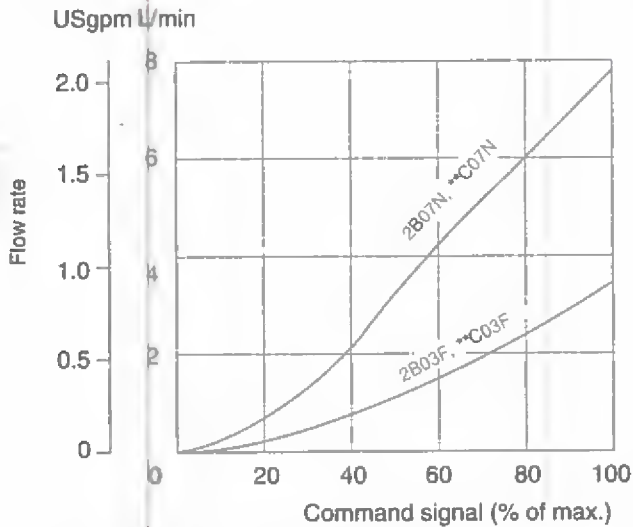


## Flow Gain Curves

### K(B)FD/TG4V-3

Spool types as noted

Single flowpath (e.g. P-A) pressure drop,  
 $\Delta p = 5 \text{ bar (72 psi)}$



At other  $\Delta p$  values and within the power capacity envelopes, flow rates approximate to:

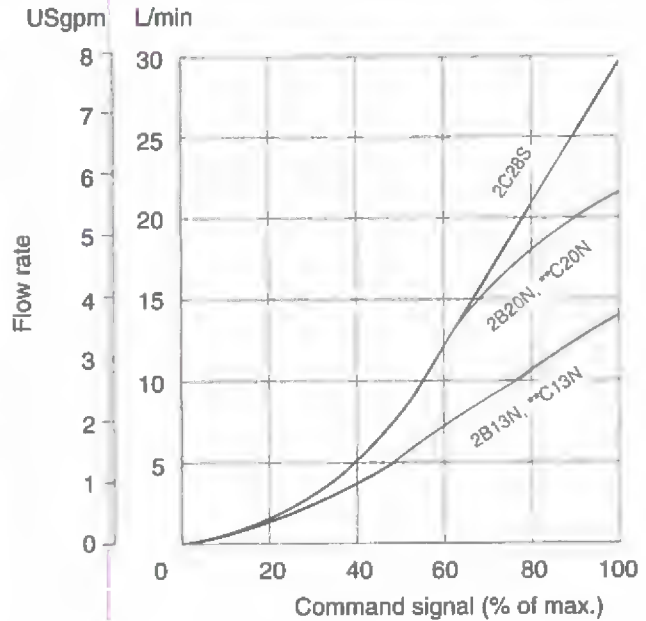
$$Q_x = Q_d \sqrt{\frac{\Delta p_x}{\Delta p_d}}$$

where  $Q_d$  = Datum flow rate  
 $\Delta p_d$  = Pressure drop at datum flow rate  
 $\Delta p_x$  = Required  $\Delta p$

When using the single solenoid throttle valve version (K\*FT) a parallel flowpath module (page B.65) can be used to approximately double the flow rate.

KBF valves are preset at the factory to compensate for the effect of spool overlap.

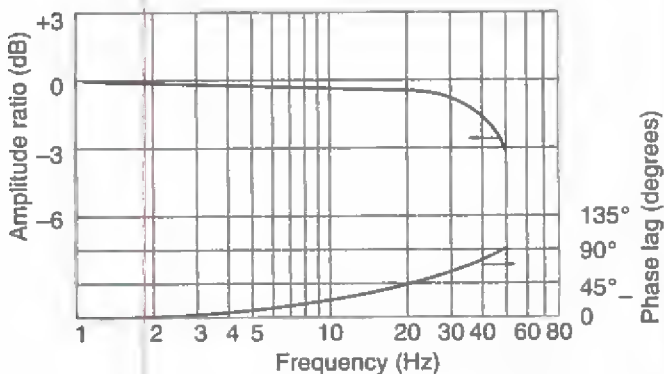
Curves shown include deadband compensation provided for the KF valve by the Vickers Eurocard Amplifier EEA-PAM-533\*-32 (user adjustable)



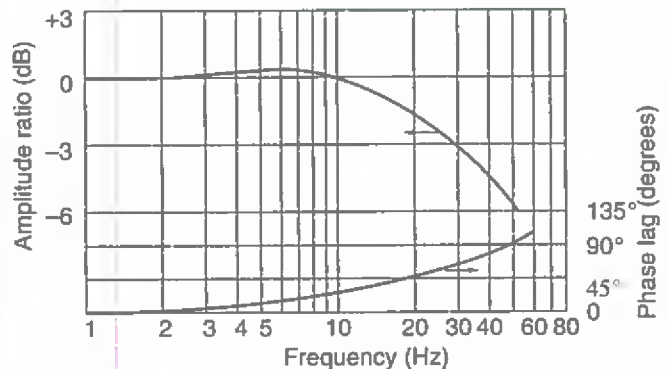
## Frequency Response (Typical)

For an amplitude of  $\pm 25\%$  max. stroke about the 50% position,  
 at  $\Delta p$  (P-B) = 5 bar (72 psi)

### KBFD/TG4V-3



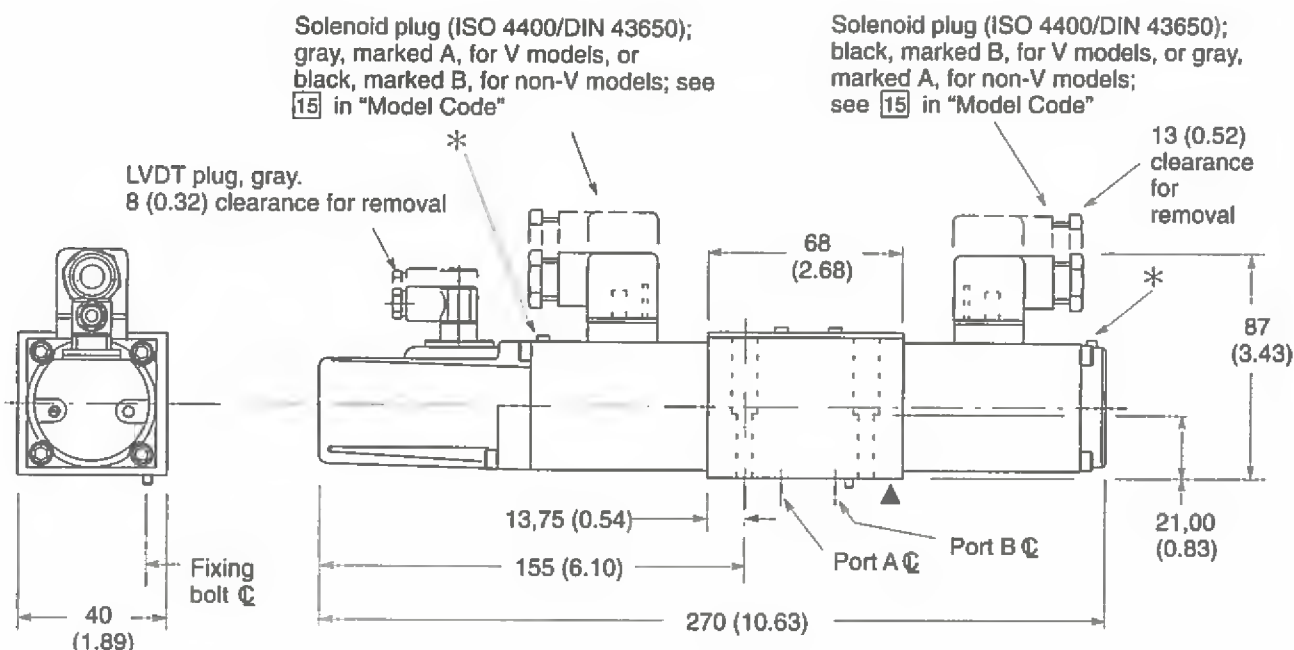
### KFD/TG4V-3



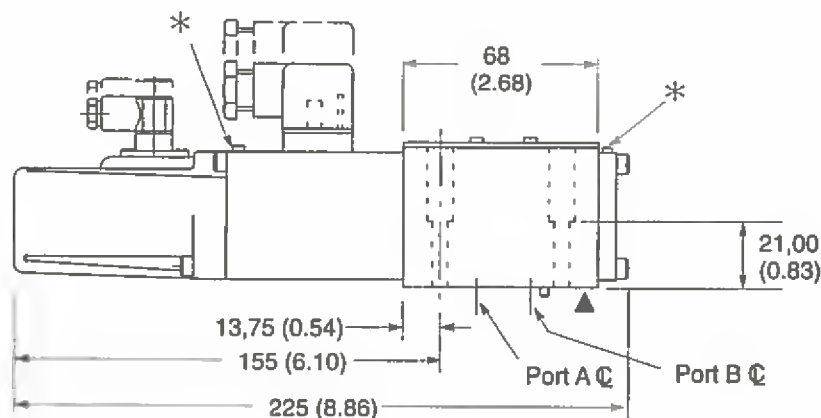
# Installation Dimensions

KFDG4V-3

3rd angle  
projection



KFTG4V-3



▲ Mounting surface seals supplied

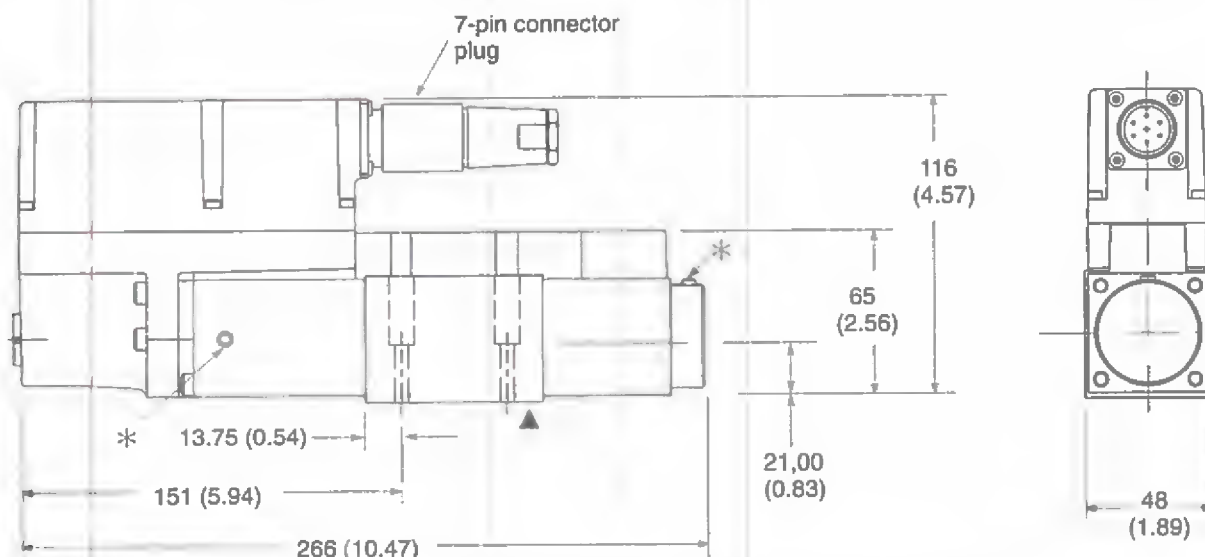
\*Note: Bleed screw locations Air bleed, Socket Head Cap Screw. Torque to 2,5-3,0 Nm (2.0-2.5 lbf ft)

**NOTE:** For optimum valve operation, bleed the air from the proportional solenoids at initial start-up. This may be done as follows:

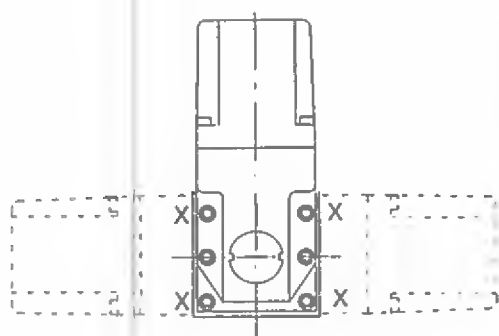
- The valve may be pressurized by removing the bleed screws until no bubbles appear and then reinstalling bleed screws, or...
- Remove both bleed screws, and use a standard oil can nozzle to pump fluid in one side until it flows, free of air bubbles, out the other side. Reinstall screws.

If there is no inherent back pressure in the tank port of the circuit do not allow the tank line to empty. This may be prevented by installing a check valve in the tank line. The cracking pressure of the check valve should be in the range of 22 - 45 psi (1.5 - 3 bar)

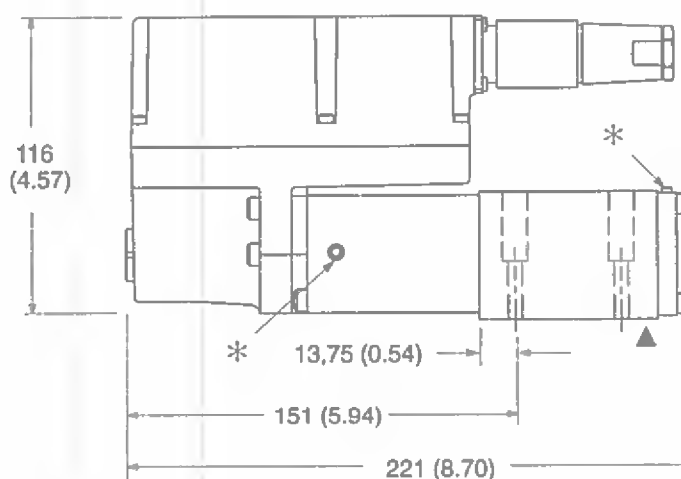
# KBFDG4V-3



# KBFTG4V-3



Amplifier and solenoid may be rotated 90° as shown by removing 4 screws shown X. Re-torque to 7-9 Nm (6-7 lbf ft)



## Warning

Valves with integral amplifiers are supplied with or without the metal 7-pin plug. The Vickers plug, part no. 934939, must be correctly fitted to ensure that the EMC rating and IP67 rating are achieved. The plug retaining nut must be tightened with a torque of 2-2,5 Nm (1.5-2.0 lbf ft) to effect a proper seal)

For mounting surface dimensions and sub-plate options, see page B.65.

\*Note: Bleed screw locations *Air bleed, Socket Head Cap Screw. Torque to 2,5-3,0 Nm (2.0-2.5 lbf ft)*

▲ Mounting surface seals supplied

# Parallel Path Flow Module

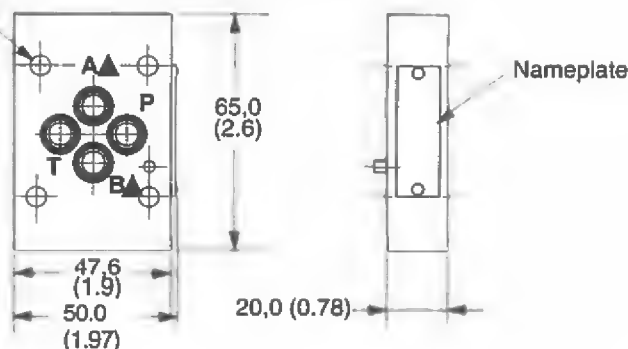
## Size 03 Parallel-Flow-Path Module KDGMA-3-616265-1\*



Typically used for doubling effective flow capability of single solenoid proportional valves (throttle valves), as illustrated in "Typical Applications".

▲ A, T<sub>A</sub> and T<sub>B</sub> ports at subplate face are blind holes fitted with O-seals.

4 holes Ø5,6 (0.22 dia), counterbored to Ø9,5 (0.374 dia)



## Subplates and Mounting Surfaces

### General Description

If a subplate is not used, a machined pad must be provided for valve mounting. Pad must be flat within 0,0127 mm (.0005 inch) and smooth within 1,6 µm (63 microinch). Mounting bolts, when provided by customer, should be ISO 898 class 12.9 or better.

### Dimensional Tolerances

Dimensional tolerance on interface drawings is  $\pm 0,2$  mm ( $\pm 0.008$ ") except where otherwise stated. ISO 4401 specifies inch conversion to  $\pm 0.01$ ".


### Conversion from Metric

ISO 4401 gives dimensions in mm. Inch conversions are accurate to 0.01" unless otherwise stated.

### Mounting Bolt Tappings

ISO 4401 gives metric thread tappings. Alternate UNC tappings are Vickers recommendations that allow these plates and associated valves to be used up to their maximum pressures, when using Vickers recommended bolt kits, or bolts of an equivalent strength. It is recommended that Customer's own manifold blocks for UNC bolts should be tapped to the minimum depths given in the footnotes.

## Subplates

Description and Mass kg (lb)	Functional Symbol	Model Code	Max. Pressure
Single-station subplate; rear ports P, T, A, B; side port L Cast iron 1,3 (2.9)		KDGVM-3-1*-R▲ KDGVM-3-676803-1* (SAE/UNF ports)	250 bar (3600 psi)

\*Design number subject to change. No change of installation dimensions for design numbers 10 to 19 or 21 to 29 inclusive.

▲ "S" suffix=SAE/UNC ports and/or UNC fixing bolt tappings and/or orifice plugs as appropriate.

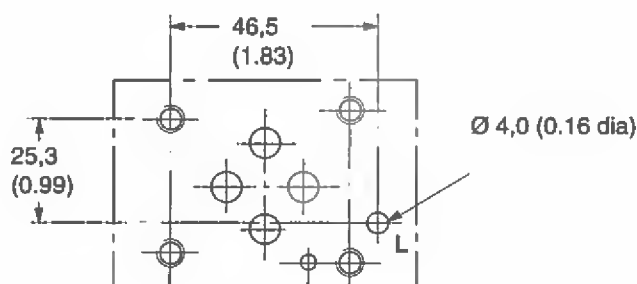
"R" suffix=BSPF and/or metric fixing bolt tappings and/or orifice plugs as appropriate.

### Interface with Additional Drain Port

The interface conforms to Vickers standard, plus hole "L"

Typically used for proportional and other valves requiring an additional drain port, e.g.:

K(B)FDG4V-3  
K(B)FTG4V-3  
K(B)SDG4V-3





# Installation Dimensions

## Single-Station Subplates

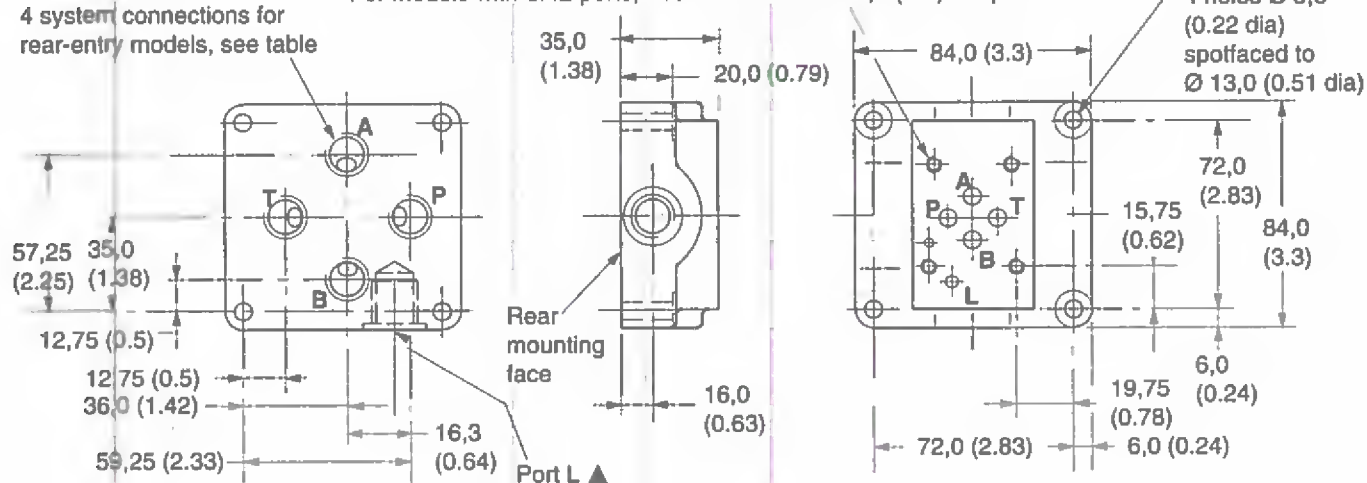
All dimensions in mm (inches)

4 holes tapped according to model type (see table):

For models with BSPF ports, M5 x 12 (0.47) deep

For models with SAE ports, #10-24 UNC-2B x 12,7 (0.5) deep

4 system connections for rear-entry models, see table



## Port Threads

Model	Ports P, T, A, B	Port L
<b>BSPF ports/M5 mounting bolts:</b>		
KDGV-3-1*-R	Rear $G^{3/8}$ " ( $3/8$ " BSPF) x 12,0 (0.47) deep	$G^{1/8}$ " ( $1/8$ " BSPF) x 12,0 (0.47) deep
<b>SAE ports/#10-24 UNC mounting bolts:</b>		
KDGV-3-576803-1*	Rear $3/4$ "-16 UNF-2B x 14,3 (0.56) deep (SAE)	$7/16$ "-20 UNF-2B x 11,6 (0.46) deep (SAE)

▲ 11,5 (0.45) from rear mounting face to port center line.

## Mounting Surface to ISO 4401 (Size 03)

This interface conforms to:

ISO 4401-03-02-0-94

plus location pin hole

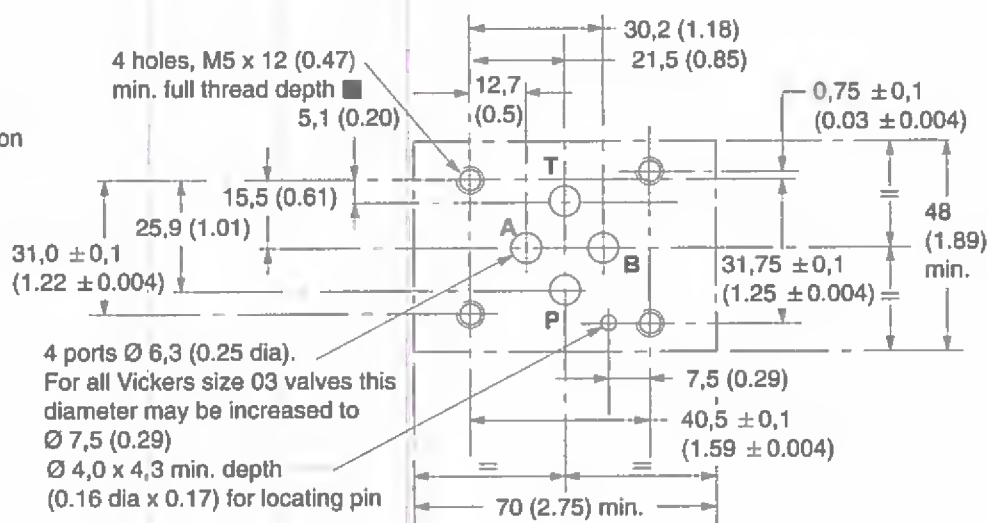
ANSI/B93.7M (and NFPA) size 03

CETOP R35H4.2-4-03, plus location

pin hole

DIN 24340 Form A6 plus location

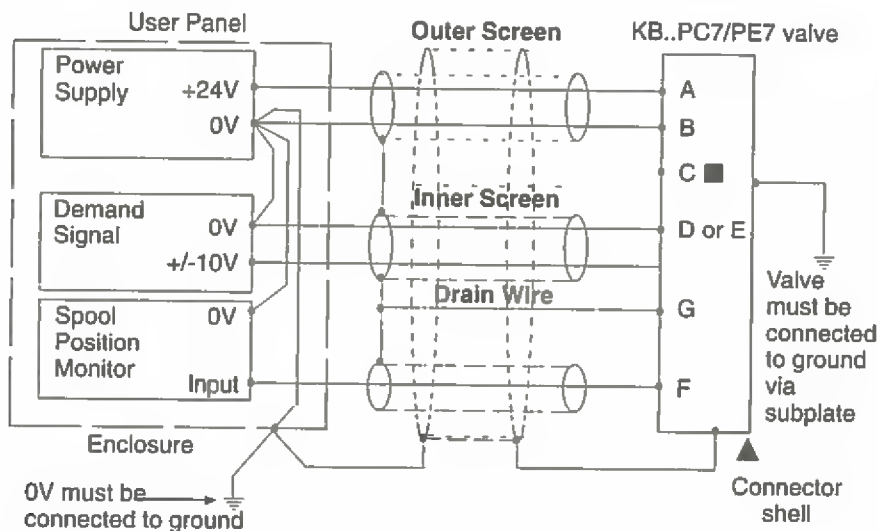
pin hole



■ #10-24 UNC-2B optional.

# Typical Connection Arrangements

## Wiring Connections



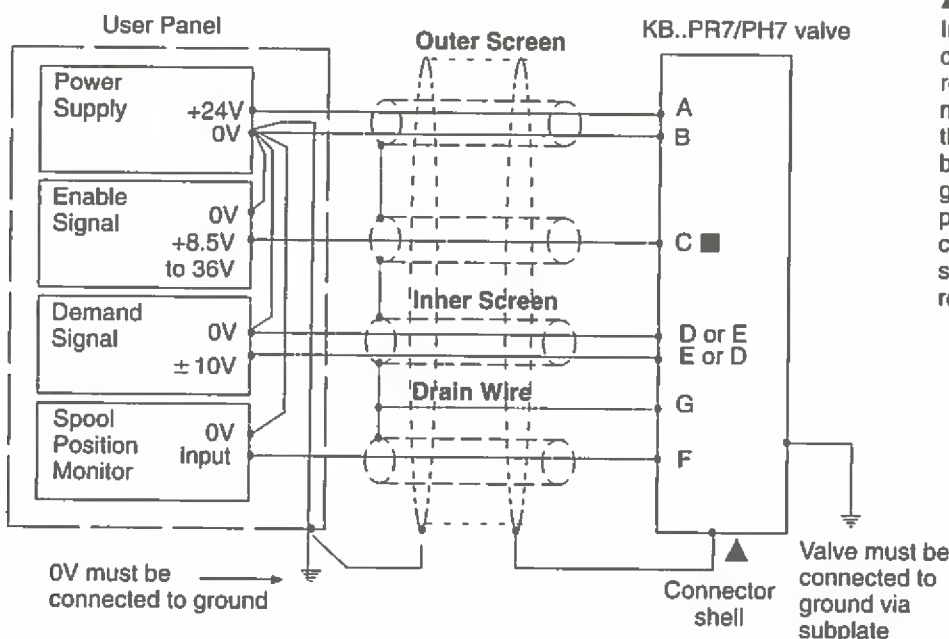
■ Spool position monitor voltage (pin F) will be referenced to the KB valve local ground. A "local ground" (pin C) is provided on PC7/PE7 versions for optional use by differential input customer supplied electronics.



### WARNING

Do not ground pin C. If the local ground (pin C) is not used for differential monitor electronics, do not use. Read monitor pin F with respect to ground.

## Wiring Connections for Valves with Enable Feature



### ▲ Note:

In applications where the valve must conform to European RFI/EMC regulations, the outer screen (shield) must be connected to the outer shell of the 7 pin connector, and the valve body must be fastened to the earth ground. Proper earth grounding practices must be observed in this case, as any differences in command source and valve ground potentials will result in a screen (shield) ground loop.



### Warning

#### Electromagnetic Compatibility (EMC)

It is necessary to ensure that the valve is wired up as above. For effective protection the user electrical cabinet, the valve subplate or manifold and the cable screens should be connected to efficient ground points. The metal 7 pin connector part no. 934939 should be used for the integral amplifier.

In all cases both valve and cable should be kept as far away as possible from any sources of electromagnetic radiation such as cables carrying heavy current, relays and certain kinds of portable radio transmitters, etc. Difficult environments could mean that extra screening may be necessary to avoid the interference.

It is important to connect the 0V lines as shown above. The multi-core cable should have at least two screens to separate the demand signal and monitor output from the power lines.

The enable line to pin C should be outside the screen which contains the demand signal cables.

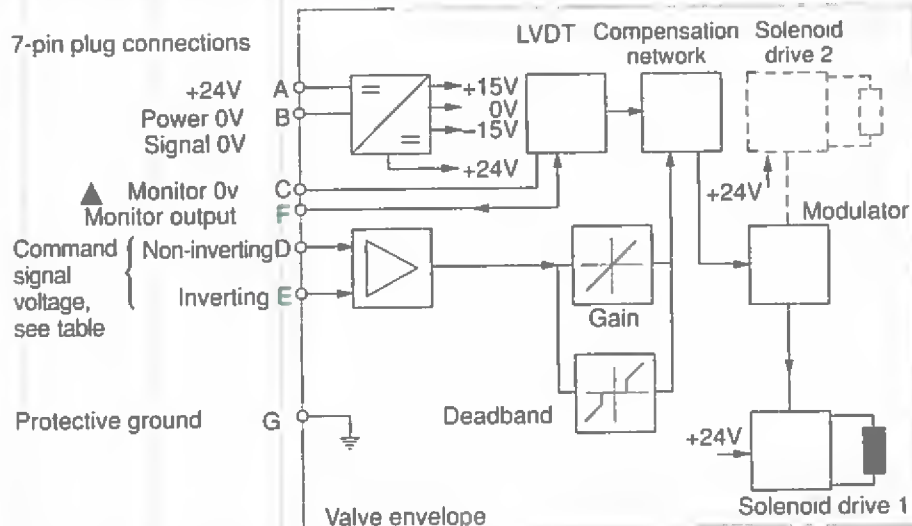
# Electrical Information

## Electrical Block Diagram

KBFDG4V-3 and KBFTG4V-3

### Command Signals and Outputs

7-pin plug		Flow direction
Pin D	Pin E	
Positive	OV	P to A
OV	Negative	
U <sub>D</sub> - U <sub>E</sub> = Positive		
Negative	OV	P to B
OV	Positive	
U <sub>D</sub> - U <sub>E</sub> = Negative		



▲ Note: In valves with PH7 or PR7 type electrical connection, pin C is used for a valve enable signal.

### Wiring

Connections must be made via the 7-pin plug mounted on the amplifier. See page B.68 of this leaflet and Installation Wiring Practices for Vickers Electronic Products, leaflet 2468. Recommended cable sizes are:

#### Power cables:

For 24V supply  
 0,75 mm<sup>2</sup> (18 AWG) up to 20m (65 ft)  
 1,00 mm<sup>2</sup> (16 AWG) up to 40m (130 ft)

#### Signal cables:

0,50 mm<sup>2</sup> (20 AWG)

#### Screen (shield):

A suitable cable would have 7 cores, a separate screen for the signal wires and an overall screen.  
 Cable outside diameter 8,0–10,5 mm (0,31–0,41 inches)  
 See connection diagram on next page.

### KFDG4V-3 and KFTG4V-3

#### Wiring

Wiring details for these valves are contained in the appropriate Eurocard literature and the Installation Wiring Practices for Vickers Electronic Products leaflet 2468.



#### Warning

All power must be switched off before connecting or disconnecting any plugs.

# Application Data

## Fluid Cleanliness

Proper fluid condition is essential for long and satisfactory life of hydraulic components and systems. Hydraulic fluid must have the correct balance of cleanliness, materials and additives for protection against wear of components, elevated viscosity and inclusion of air.

Recommendations on contamination control methods and the selection of products to control fluid condition are included in Vickers publication 9132 or 561, "Vickers Guide to Systemic Contamination Control". The book also includes information on the Vickers concept of "ProActive Maintenance". The following recommendations are based on ISO cleanliness levels at 2 µm, 5 µm and 15 µm.

For products in this catalog the recommended levels are:

0 to 70 bar (1000 psi)	18/16/13
70 + bar (1000 + psi)	17/15/12

Vickers products, as any components, will operate with apparent satisfaction in fluids with higher cleanliness codes than those described. Other manufacturers will often recommend levels above those specified.

Experience has shown, however, that life of any hydraulic components is shortened in fluids with higher cleanliness codes than those listed below. These codes have been proven to provide a long trouble-free service life for the products shown, regardless of the manufacturer.

## Hydraulic Fluids

Materials and seals used in these valves are compatible with antiwear hydraulic oils, and non-alkyl-based phosphate esters. The extreme operating viscosity range is 500 to 13 cSt (2270 to 70 SUS) but the recommended running range is 54 to 13 cSt (245 to 70 SUS).

## Installation

The proportional valves in this catalog can be mounted in any attitude, but it may be necessary in certain demanding applications, to ensure that the solenoids are kept full of hydraulic fluid. Good installation practice dictates that the tank port and any drain port are piped so as to keep the valves full of fluid once the system start-up has been completed.

## Mounting Bolt Kits

For K(B)FD/TG4V-3

BK02-156493M (metric)

BK590716 (inch)

*If not using Vickers recommended bolt kits, bolts used should be to ISO 898, 12.9 or better.*

## Seal Kits

KFD/TG4V-3

KBFD/TG4V-3-1\*

565108

02-332693

## Plugs

KBFDG4V

7-pin plug (metal) ..... 934939

7-pin plug (plastic) ..... 694534

(NOTE: Metal plug must be used for full EMC protection)

**NOTE:** An alternative metal connector which gives EMC protection but not IP67 rating is available from ITT-Cannon, part number CA02-COM-E-14S-A7-P.

KFDG4V

Solenoid (black) ..... 710775

Solenoid (gray) ..... 710776

LVDT (gray) ..... 458939

## Extension Cable

**Extension Cable:** Adapter for extending 7 core cable when changing from KA to KB valve and existing wiring is not long enough. Consists of a 7 pin plug, a 7 pin socket and a length of cable, fully assembled for ease of use

Extension Cable ..... 944450

## Service Information

The products from this range are preset at the factory for optimum performance; disassembling critical items would destroy these settings. It is recommended that if any mechanical or electronic repair is necessary, valves should be returned to the nearest Vickers repair center. The products will be refurbished as necessary and retested to specification before return.

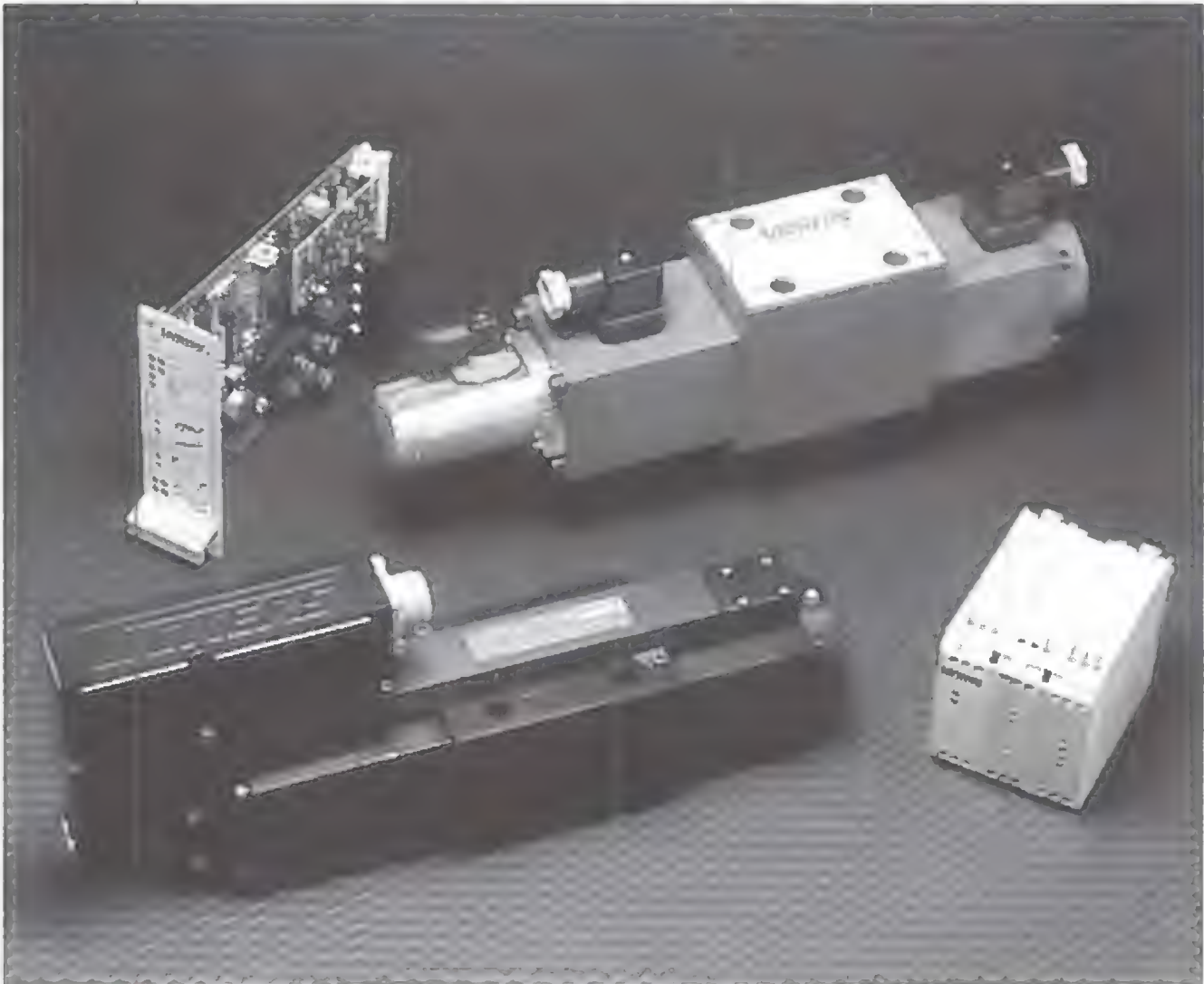
Field repair is restricted to replacement of the seals.

*Note: The feedback/solenoid assembly installed in this valve should not be disassembled.*

## Proportional Directional Valves with Feedback

K(B)FD/TG4V-5, 1\*1/2\* Series

Pressures to 315 bar (4500 psi)



This product has been designed and tested to meet specific standards outlined in the European Electromagnetic Compatibility Directive (EMC) 89/336/EEC, amended by 91/263/EEC, 92/31/EEC and 93/68/EEC, article 5. For instructions on installation requirements to achieve effective protection levels, see this leaflet and the Installation Wiring Practices for Vickers Electronic Products leaflet 2468. Wiring practices relevant to this Directive are indicated by  Electromagnetic Compatibility (EMC).

5071.01/EN/1097/A



# Introduction

## General Description

Vickers proportional valves shown in this catalog are designed to provide a controlled oil flow in direct proportion to a command signal. They are available in two types; a double solenoid version that will provide reversible flow to an actuator and a single solenoid throttle version that provides a single direction of flow. Hydrostats are available for load compensation and parallel flow path modules are available that will boost the flow capacity of single solenoid throttle versions to nearly twice that of the standard valve.

Additionally, both of these valve types can be supplied with or without an integral amplifier built directly onto the valve.

### KFD/TG4V-5

This version is supplied *without* the integral amplifier.

#### Features and Benefits

- Wide range of spool and flow rate options.
- Electronic feedback LVDT ensures accurate spool position control.
- Internal current feedback provides optimal control.

- Vibration and shock tested.
- Supported by a broad range of amplifiers and auxiliary function modules.
- Full CE electromagnetic compatibility.

### KBFD/TG4V-5

A range of proportional directional and throttle valves *with* integral control electronics. Factory-set adjustments of gain, spool deadband compensation and offset ensure consistent repeatability valve-to-valve.

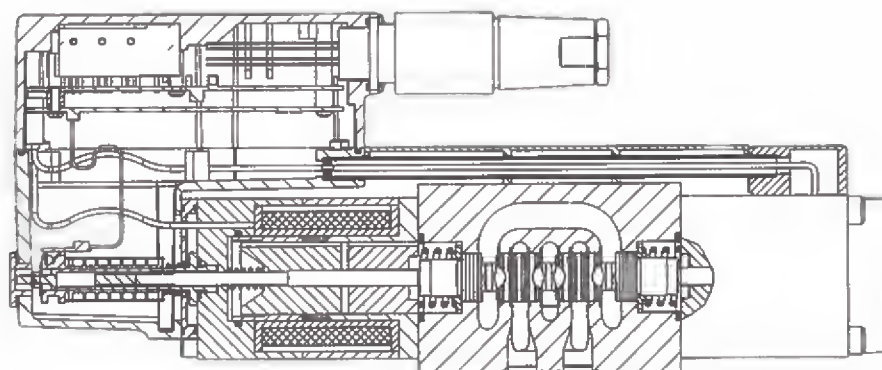
The only electrical inputs required are power supply (24V) and a voltage command signal of  $\pm 10V$ . The amplifier is housed in a robust metal enclosure, sealed against ingress of water and other fluids. Electrical connections are via a standard 7-pin plug.

A spool position monitor pin allows the function of the valve to be electrically monitored. Ramp functions, if required, can be generated externally.

## Features and Benefits

- Factory-sealed adjustments ensure valve-to-valve reproducibility.
- Installation wiring reduced and simplified.
- Standard 7-pin connector.
- Standard 24V DC supply with wide tolerance band.
- Standard  $\pm 10V$  DC command signals.
- Valve with integrated amplifier selected, ordered, delivered and installed as one performance-tested package.
- Spool position monitor pin to help with troubleshooting.
- Simple valve removal and replacement for service (plug & play).
- Vibration and shock tested.
- Auxiliary DIN rail mounted electronic function modules available.
- Full CE electromagnetic compatibility.
- IP67 valve environmental protection rating.
- Optional valve enable function.

## Typical Section View



KBFD/TG4V-5- $\pi$ C, 1 $\pi$  Design

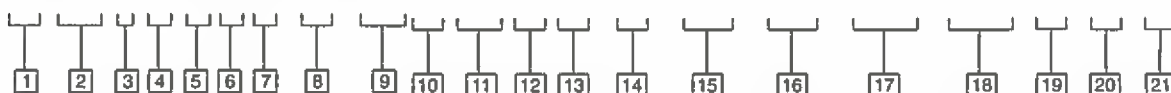
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# Model Codes

**K (B)F \* G4 V - 5 - \*\* \* \*\* \* \*\* - Z - (V) - (M) - (U1) - (\*\*\*) - H - \* - \***



## 1 Valve type

K – Proportional valve

## 2 Integral amplifier

B – Integral amplifier “B” series  
Omit for models *without* integral amplifier

## 3 Feedback arrangement

F – Spool position

## 4 Control type

D – Directional valve  
T – Throttle valve

## 5 Mounting

G – Subplate mounted

## 6 Operation

4 – Solenoid operated

## 7 Pressure rating

V – 315 bar (4500 psi) on ports  
P, A, & B

## 8 Interface

5 – ISO 4401, size 05-04-0-94  
ANSI/B93.7M-Size 05

## 9 Spool type (center condition) (see spool data, page B.74)

2 – Closed center (all ports)  
33 – P port closed, bleed A & B to T

## 10 Spool/spring arrangement

B – Spring centered single solenoid valve  
(solenoid “B” only) Solenoid “A” for  
“V” version  
C – Spring centered, dual solenoid

## 11 Spool flow rating

$\Delta p = 5$  bar (75 psi) per metering flow  
path, e.g. B to T. For actual maximum  
flow refer to power capacity envelope  
curves page B.77).

30 – 30 L/min (7.9 USgpm) ▲  
50 – 50 L/min (13.2 USgpm) ▲  
65 – 65 L/min (17.2 USgpm) □  
70 – 70 L/min (18.5 USgpm) ▲■  
▲ Meter-in/meter-out  
□ Meter-out only  
▲■ Type-2 spool only

## 12 Spool metering type

N – Meter-in and meter-out  
S – Meter-out only

## 13 Flow rating (“B” port flow for asymmetric spools) K(B)FDG valves only

25 – 25 L/min (6.6 USgpm)  
(50N25 only)

Omit for symmetrical spool

## 14 Manual overrides

Z – No manual overrides

## 15 Solenoid energization identity

(non-integral amplifier types only, omit for  
valves with integral amplifier)

V – Solenoid “A” is at port “A” end and  
Solenoid “B” is at port “B” end  
independent of spool type  
Blank US ANSI B93.9 standard  
(energize solenoid “A”, flow  
symbol is (P→A))

## 16 LVDT plug

(omit for valves with integral amplifier)  
M – Standard LVDT (mating plug  
supplied)

## 17 Solenoid connector

(omit for valves with integral amplifier)  
U1 – ISO 4400/DIN 43650, non-integral  
amplifier type only (mating plug  
supplied)

## 18 Electrical connection (KBF valves only)

PC7 – 7 pin connector without plug  
PE7 – 7 pin electrical plug with mating  
half  
PH7 – As PE7 but with pin “C” used for  
enable signal  
PR7 – As PC7 but with pin “C” used  
for enable signal

## 19 Coil rating

H – 24 VDC amplifier supply

## 20 Port T pressure limit code

6 – for 2C\*\*S spools  
7 – for all other spools

## 21 Design number

1\* and 2\* series. Subject to change



### Warning

Valves with integral amplifiers  
are supplied with or without  
the metal 7-pin plug. The Vickers plug,  
part no. 934939, must be correctly fitted  
to ensure that the EMC rating and IP67  
rating are achieved. The plug retaining  
nut must be tightened with a torque of  
2-2,5 Nm (1.5-2.0 lbf ft) to effect a  
proper seal.

# Spool Data

## Spool Symbols

### Available Spools for K(B)FDG4V-5

Spool type 2C\*\*N, meter-in/meter-out



Spool type 2C50N25, assymetric flow



Spool Type 2C65S, meter-out only



Spool type 33C\*\*N, meter-in/meter-out



Spool type 33C50N25, assymetric flow



### Available Spools for K(B)FTG4V-5

Spool type 2B\*\*N, meter-in/meter-out



## Spool Types and Flow Ratings

### Symmetric Spools

Base line starting at  $\Delta p = 5$  bar (75 psi) per metering flow path, e.g. B to T. For actual maximum flow refer to power capacity envelope curves.

Spool code	Spool symbol	Flow rating
For K(B)FDG4V-5 valves:		
2C30N	2C	30 L/min (7.9 USgpm)
2C50N	2C	50 L/min (13.2 USgpm)
2C65S	2C	65 L/min (17.2 USgpm)
2C70N	2C	70 L/min (18.5 USgpm)
33C30N	33C	30 L/min (7.9 USgpm)
33C50N	33C	50 L/min (13.2 USgpm)

### For K(B)FTG4V-5 valves:

2B30N	2B	30 L/min (7.9 USgpm)
2B50N	2B	50 L/min (13.2 USgpm)
2B70N	2B	70 L/min (18.5 USgpm)

### Asymmetric Spools

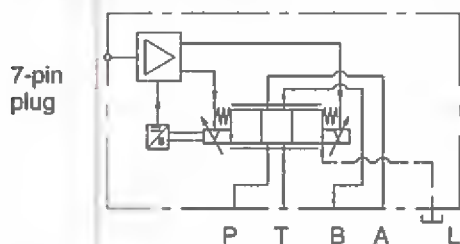
Figure preceding metering type designator, "N" (e.g. 2C\*\*\*N) is flow rating P-A, or A-T ("A" port flow); figure after "N" (N\*\*\*) is flow rating P-B, or B-T ("B" port flow).

Spool code	Spool symbol	Flow rating
For K(B)FDG4V-5 valves:		
2C50N25	2C	50 L/min (13.2 USgpm), "A" port flow 25 L/min (6.6 USgpm), "B" port flow
33C50N25	33C	50 L/min (13.2 USgpm), "A" port flow 25 L/min (6.6 USgpm), "B" port flow

## Functional Symbols

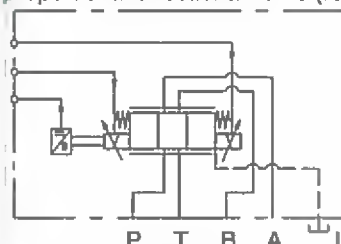
### Model Types KBFDG4V-5

proportional directional valve (with integrated electronics)



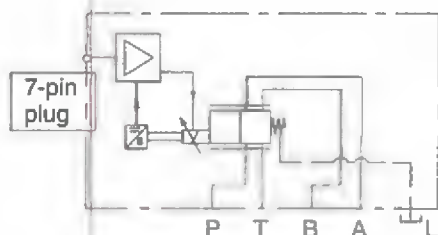
### Model Types KFDG4V-5

proportional directional valve (requires amplifier card)



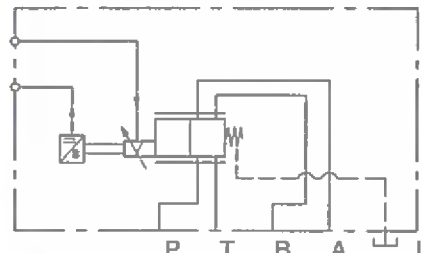
### Model Types KBFTG4V-5

proportional throttle valve (with integrated electronics)



### Model Types KFTG4V-5

proportional throttle valve (requires amplifier card)



# Operating Data

## Valves w/o integral amplifier

**KFD/TG4V-5 Valves without integral amplifier (requires a Eurocard amplifier, refer to Supporting Products)**  
Data is typical with fluid at 36 cSt (168 SUS) and 50°C (122°F).

Max current, at 50° C (122° F) ambient	2,7 A
Coil resistance, at 20° C (68° F)	2,80Ω
Step response: Step size (% of max spool stroke): 0 to 100% 100% to 0 +90 to -90% (KFDG4V-5 only)	Time to reach 90% of required step: 31 ms 30 ms 45 ms
Type of protection, with electrical plugs fitted correctly	IEC 144, Class IP67
Electromagnetic compatibility (EMC) Emission (10V/m) Immunity (10V/m)	EN 50081-2 EN 50082-2
Maximum allowable ambient air temperature	60° C (140° F)
Maximum allowable oil temperature	60° C (140° F)
Supporting products: Eurocard amplifiers EEA PAM 535 A/B/C/D/E/F	See catalog GB 2464

## KFD/TG4V-5 and KBFD/TG4V-5 Valves (all valves)

Relative duty factor	Continuous rating (ED = 100%)
Hysteresis with flow through P-A-B-T	< 1% of max stroke (center-to-offset)
Mass: KFDG4V-5 KBFDG4V-5 KFTG4V-5 KBFTG4V-5	7,2 kg (15.86 lb) approx. 7,6 kg (16.76 lb) approx. 5,5 kg (12.10 lb) approx. 5,9 kg (13.00 lb) approx.
Portable test equipment EHA TEQ 700 A 20 EBA TEQ 706 A 10	See catalog GB 2462 See catalog GB 2315

## Pressures and Flow Rates

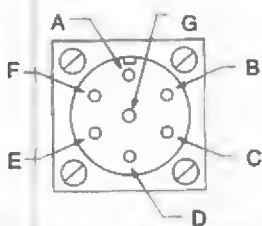
### Maximum pressures, bar (psi)

Model	Port L condition	Ports P, A, B	T	L
All models for normal usage (L port not connected)	Normally blocked by mounting surface	315 (4500)	160 (2300)	160 (2300)
For K(B)FDG4V-5-**-N-Z models only, a higher "T" port pressure is allowed if the "L" port is connected directly to tank	Drained directly to tank	315 (4500)	210 (3000)	10 (150)

# Operating Data

## Valves w/ integral amplifier

**KBFD/TG4V-5 Valves with integral amplifier** Data is typical with fluid at 36 cSt (168 SUS) and 50°C (122°F).

Power supply	24V DC (21V to 36V including 10% peak-to-peak max. ripple) max current 3A																		
Command signal Input impedance Common mode voltage to pin B	0 to +10V DC, or 0 to -10V DC, or -10 V to +10 V DC 47 kΩ 18V (max)																		
Valve enable signal for model codes PH7 & PR7 Enable Disable Input impedance	>8.5V (36V max) <6.5V 10 kΩ																		
7-pin plug connector	<table> <thead> <tr> <th>Pin</th><th>Description</th></tr> </thead> <tbody> <tr> <td>A</td><td>Power supply positive</td></tr> <tr> <td>B</td><td>Power 0V</td></tr> <tr> <td>C</td><td>Command/Monitor 0V (PE7 &amp; PC7)</td></tr> <tr> <td>D</td><td>Valve enable (PH7 &amp; PR7)</td></tr> <tr> <td>E</td><td>Command signal (+)-non-inverting input</td></tr> <tr> <td>F</td><td>Command signal (-)-inverting input</td></tr> <tr> <td>G</td><td>Monitor input</td></tr> <tr> <td></td><td>Protective ground</td></tr> </tbody> </table>	Pin	Description	A	Power supply positive	B	Power 0V	C	Command/Monitor 0V (PE7 & PC7)	D	Valve enable (PH7 & PR7)	E	Command signal (+)-non-inverting input	F	Command signal (-)-inverting input	G	Monitor input		Protective ground
Pin	Description																		
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F	Command signal (-)-inverting input																		
G	Monitor input																		
	Protective ground																		
 <p>View of pins of fixed half</p>																			
Electromagnetic compatibility (EMC): Emission (10 V/m) Immunity (10 V/m)	EN 50081-2 EN 50082-2																		
Threshold command voltage (minimum voltage for minimum flow)	0.25V																		
Monitor signal (pin F)      KBFD valves KBFT valves	± 10V DC for full spool stroke 0 to -10V DC for full spool stroke																		
Output impedance	10kΩ																		
Power stage PWM frequency	10 kHz nominal																		
Step input response with flow through P-A-B-T Δp=5 bar (75psi) per metering path, e.g. P-A Required flow step: 0-100% 100% - 0 +90 - -90% (KBFDG4V-5 only)	Time to reach 90% of required step: 28 ms 28 ms 35 ms																		
Reproducibility, valve-to-valve (at factory settings): Flow at 100% command signal	≤ 5%																		
Protection: Electrical Environmental	Reverse polarity protected IEC 144, Class IP67																		
Ambient air temperature range for full performance Oil temperature range for full performance	0° C to 70° C (32° F to 158° F) 0° C to 70° C (32° F to 158° F)																		
Minimum temperature at which valves will work at reduced performance	-20° C (-4° F)																		
Storage temperature range	-25° C to +85° C (-13° F to +185° F)																		
Supporting products:																			
Auxiliary electronic modules (DIN -rail mounting):																			
EHA-CON-201-A2* signal converter	See catalog GB 2410A																		
EHD-DSG-201-A-1* command signal generator	See catalog GB 2470																		
EHA-RMP-201-A-2* Ramp generator	See catalog GB 2410A																		
EHA-PSU-201-A-10 Power supply	See catalog GB 2410A																		
EHA-PID-201-A-20 PID controller	See catalog GB 2427																		

# Performance Curves

## Power Capacity Envelopes

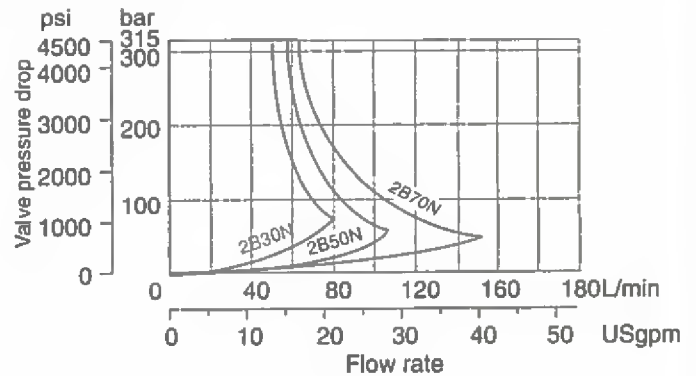
Single solenoid models:

K(B)FTG4V-5

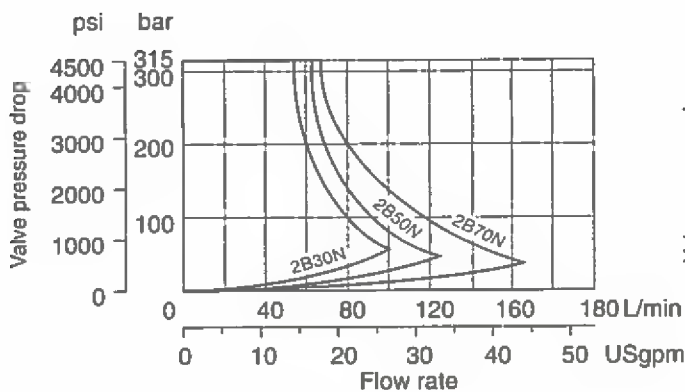
Spool types as noted

Subject to maximum pressure limitations according to model type. See "Maximum Pressures" on page B.76.

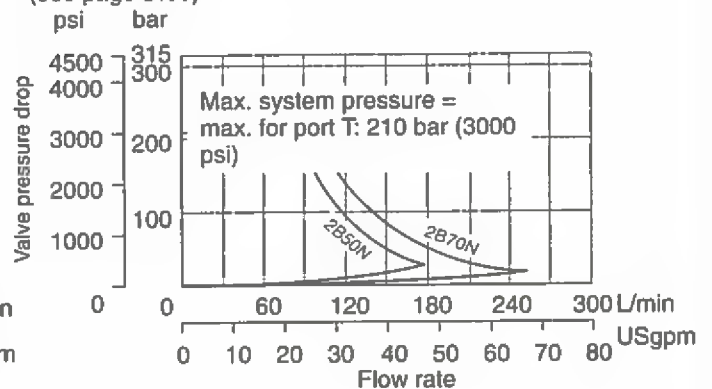
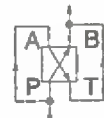
Looped Flow Path



Single Flow Path



Parallel Flow Path use parallel flow path module: KDGMA-5-616877-10R or KDGMA-5-02-139150-10S (see page B.85)

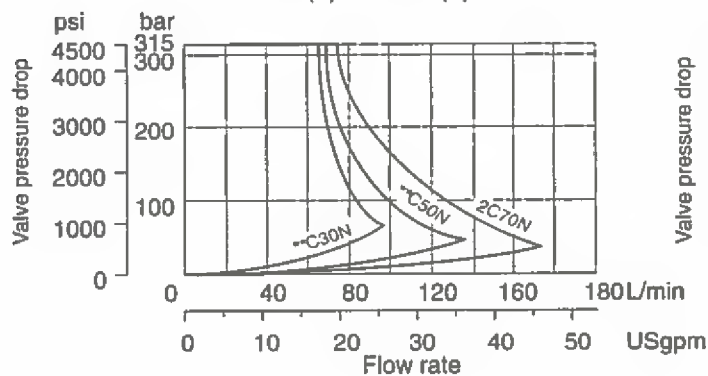
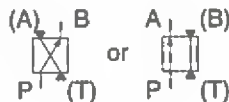


Double Solenoid Models:

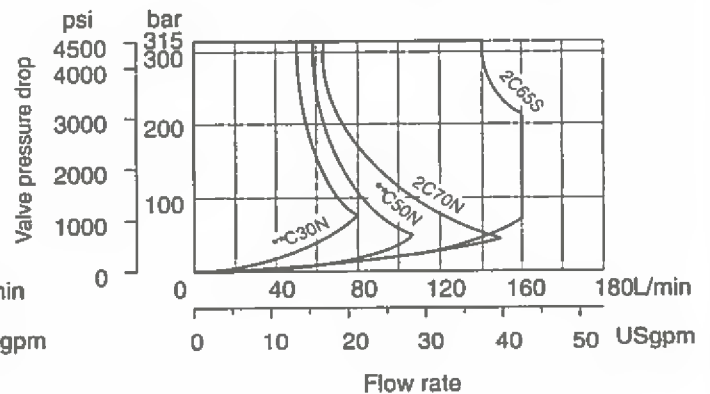
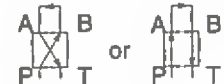
K(B)FDG4V-5

Spool types as noted

Single Flow Path



Looped Flow Path



# Performance Curves

## Flow Gain

K(B)FD/TG4V-5

Spool types as noted

Single flowpath (e.g. P-A) pressure drop,  
 $\Delta p = 5 \text{ bar (75 psi)}$  ■.

When using the single solenoid throttle valve (K\*FT), a dual flowpath module (page B.85) can be used to approximately double the flow rate.

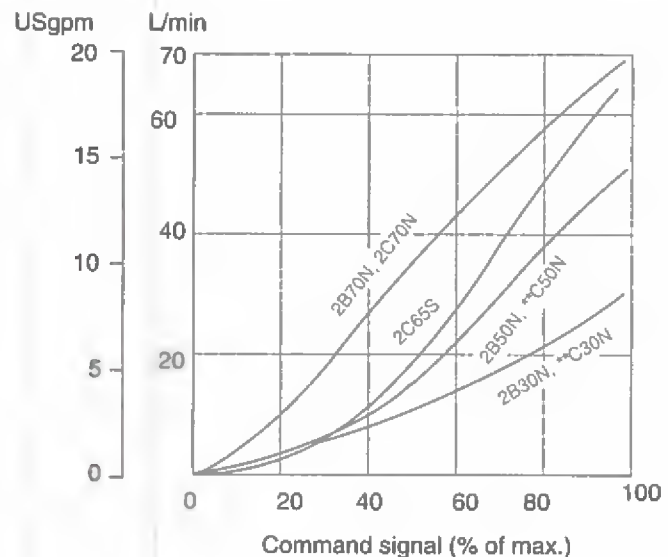
Curves shown include deadband compensation provided for the KF valve by the Vickers Eurocard Amplifier EEA-PAM-535-A-32 (user adjustable).

KB valves are preset at the factory to compensate for the effect of spool overlap.

■ At other  $\Delta p$  values and within the power capacity envelopes, flow rates approximate to:

$$Q_x = Q_d \sqrt{\frac{\Delta p_x}{\Delta p_d}}$$

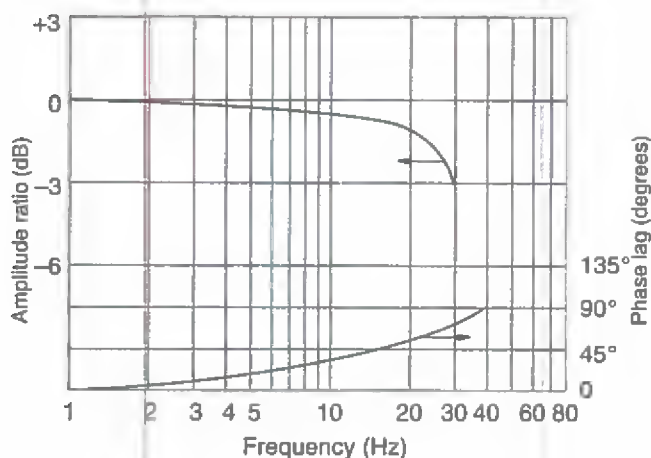
where  $Q_d$  = Datum flow rate  
 $\Delta p_d$  = Pressure drop at datum flow rate  
 $\Delta p_x$  = Required  $\Delta p$



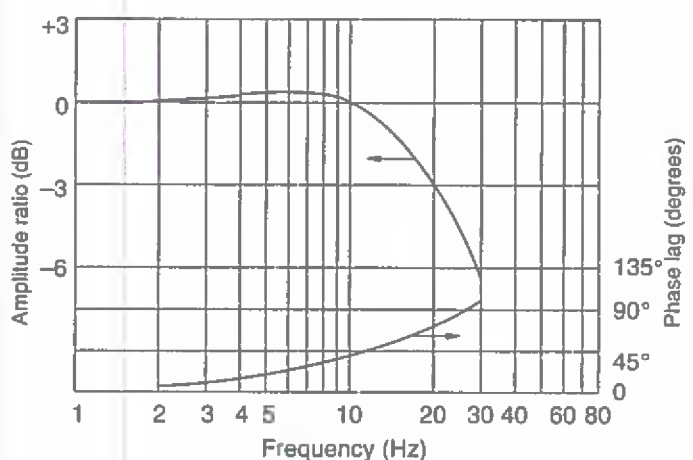
## Frequency Response (Typical)

For an amplitude of  $\pm 25\%$  max. stroke about the 50% position at  $\Delta p$  (P-B) = 5 bar (75 psi)

KBFD/TG4V-5



KFD/TG4V-5

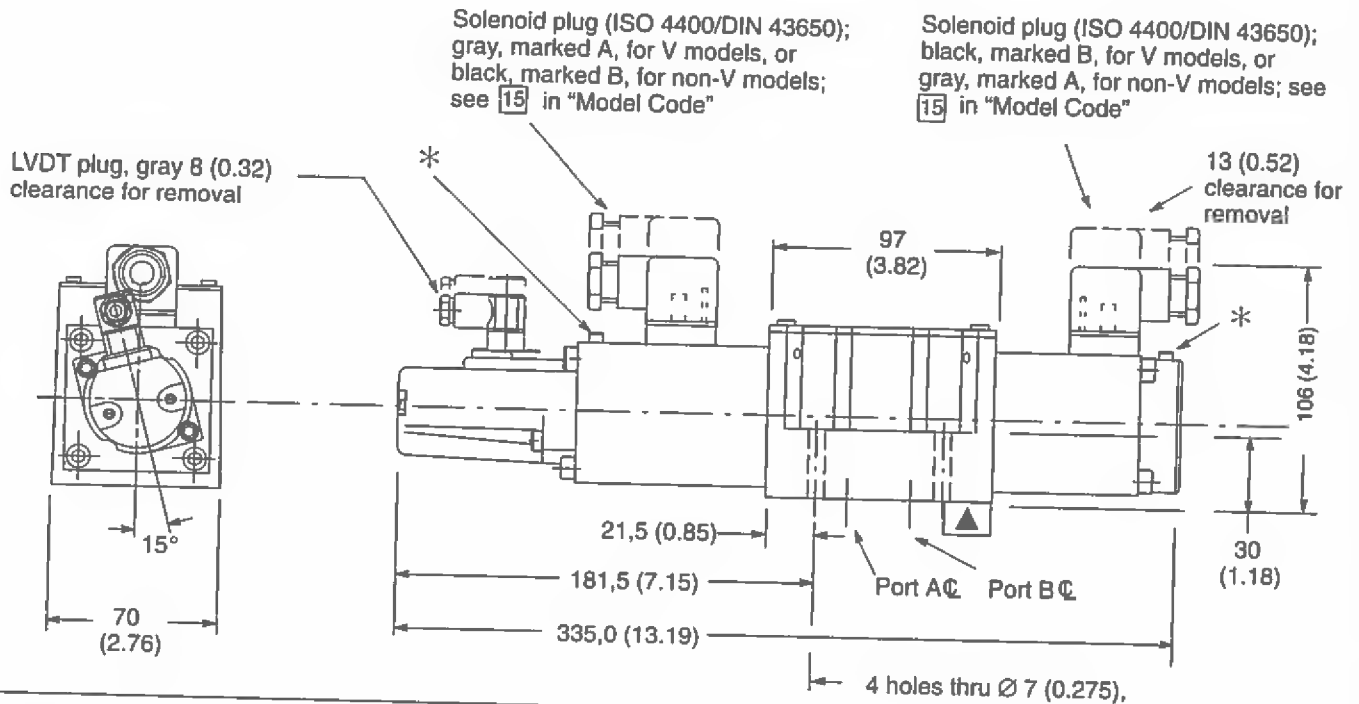




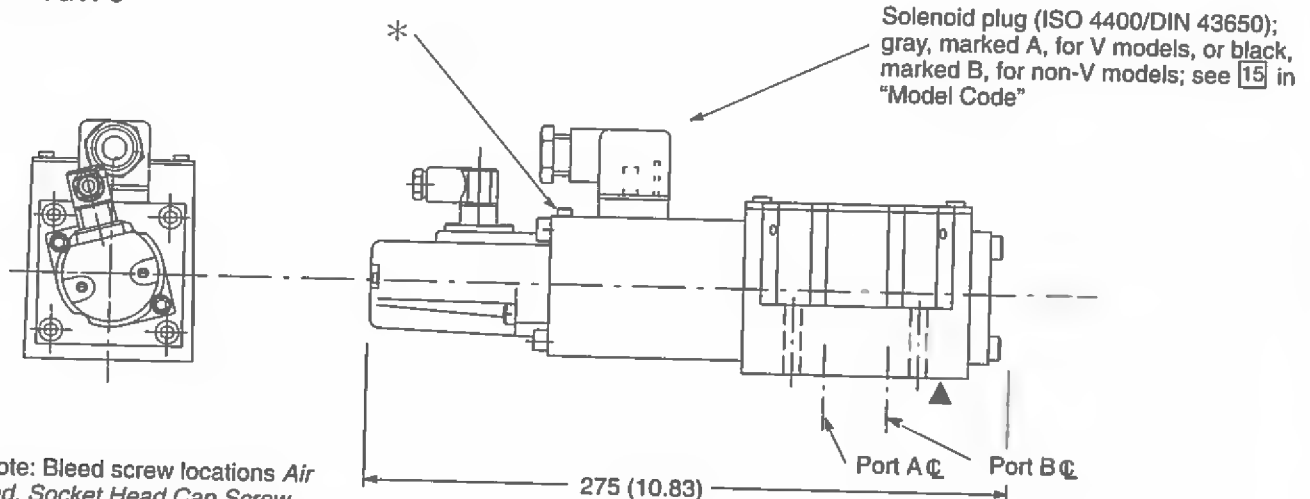
# Installation Dimensions

KFDG4V-5  
mm (inch)

3rd angle  
projection



KFTG4V-5



\*Note: Bleed screw locations Air bleed, Socket Head Cap Screw. Torque to 2,5-3,0 Nm (2.0-2.5 lbf ft)

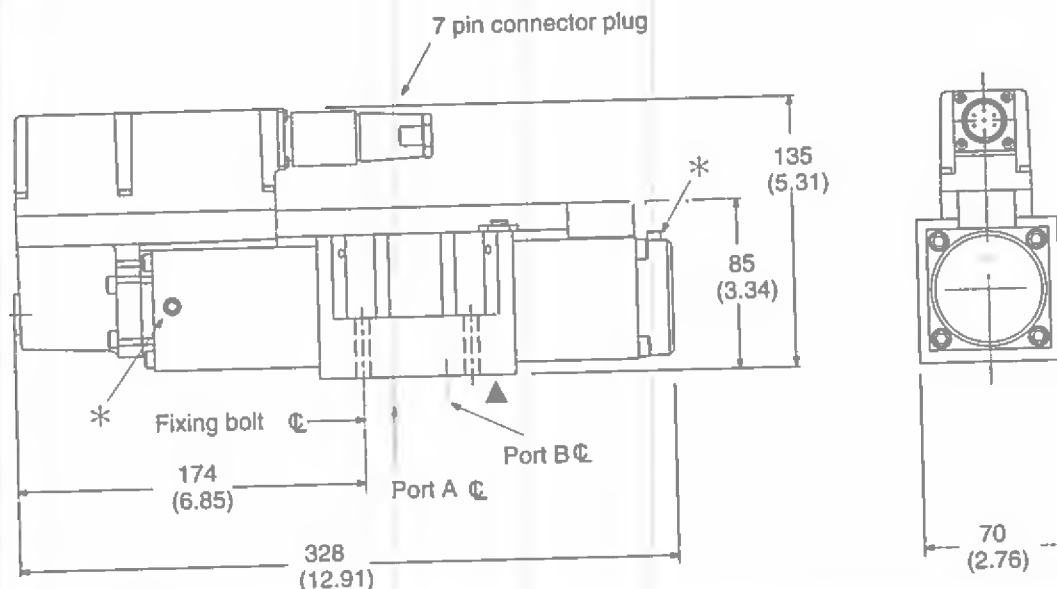
**NOTE:** For optimum valve operation, bleed the air from the proportional solenoids at initial start-up. This may be done as follows:  
• The valve may be pressurized by removing the bleed screws until no bubbles appear and then reinstalling bleed screws, or...

• Remove both bleed screws, and use a standard oil can nozzle to pump fluid in one side until it flows, free of air bubbles, out the other side. Reinstall screws.

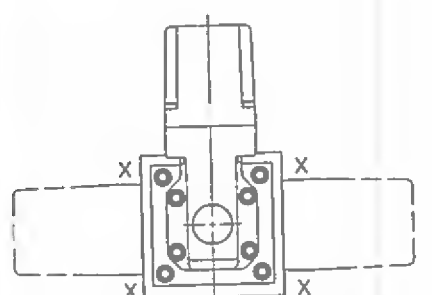
If there is no inherent back pressure in the tank port of the circuit do not allow the tank line to empty. This may be prevented by installing a check valve in the tank line. The cracking pressure of the check valve should be in the range of 22 - 45 psi (1.5 - 3 bar)



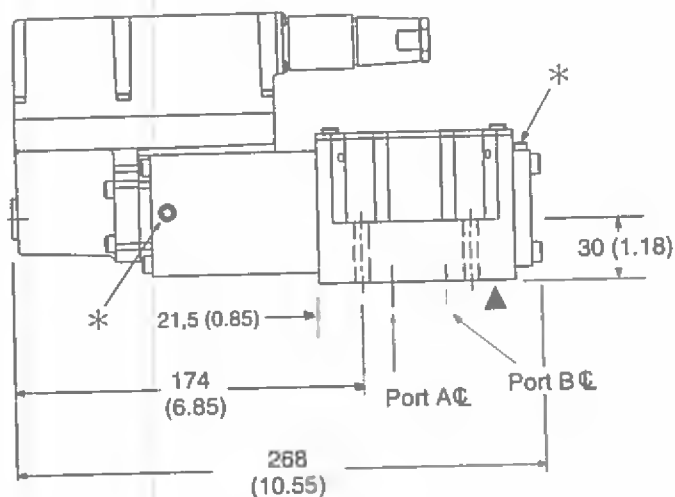
**KBFDG4V-5**  
mm (inch)



**KBFTG4V-5**



Amplifier and solenoid assembly may be rotated 90° as shown by removing 4 screws shown X. Re-torque to 13-15 Nm (10-11 lbf ft)



**Warning**

Valves with integral amplifiers are supplied with or without the metal 7-pin plug. The Vickers plug, part no. 934939, must be correctly fitted to ensure that the EMC rating and IP67 rating are achieved. The plug retaining nut must be tightened with a torque of 2,0-2,5 Nm (1.5-2.0 lbf ft) to effect a proper seal.

\*Note: Bleed screw locations Air bleed, Socket Head Cap Screw. Torque to 2,5-3,0 Nm (2.0-2.5 lbf ft)

▲ Mounting surface seals supplied. For Mounting surface dimensions and sub-plate options see page B.81 , Subplates and mounting surfaces.

# Subplates and Mounting Surfaces

## General Description

When a subplate is not used, a machined pad must be provided for valve mounting. Pad must be flat within 0,0127 mm (.0005 inch) and smooth within 1,6 µm (63 microinch). Mounting bolts, when provided by customer, should be ISO 898 class 12.9 or better.

## Dimensional Tolerances

Dimensional tolerance on interface drawings is  $\pm 0,2$  mm ( $\pm 0.008$ ") except where otherwise stated. ISO 4401 specifies inch conversion to  $\pm 0.01$ ".

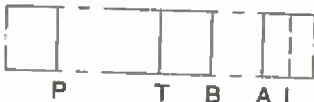
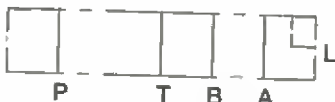
## Conversion from Metric

ISO 4401 gives dimensions in mm. Inch conversions are accurate to 0.01" unless otherwise stated.

## Mounting Bolt Tappings

ISO 4401 gives metric thread tappings. Alternate UNC tappings are Vickers recommendations that allow these plates and associated valves to be used up to their maximum pressures, when using Vickers recommended bolt kits, or bolts of an equivalent strength. It is recommended that Customer's own manifold blocks for UNC bolts should be tapped to the minimum depths given in the footnotes.

## Subplates

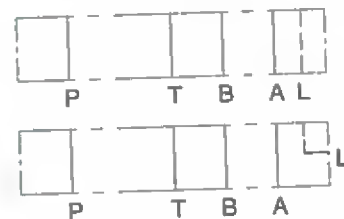
Description and Mass kg (lb)	Functional Symbol	Model Code	Max. Pressure
Single-station subplate; rear ports P, T, A, B; and port L (side or rear) Cast iron 1,3 (2.9)		KDGSM-5-67805-20 (SAE/UNF ports)	210 bar (3000 psi)
		KDGSM-5-615225-10 1/2" BSPF ports KDGS-5-615226-10 3/4" BSPF ports	315 bar (4500 psi)
		EKDGS-01Y-10-R	280 bar (4000 psi)

# Installation Dimensions

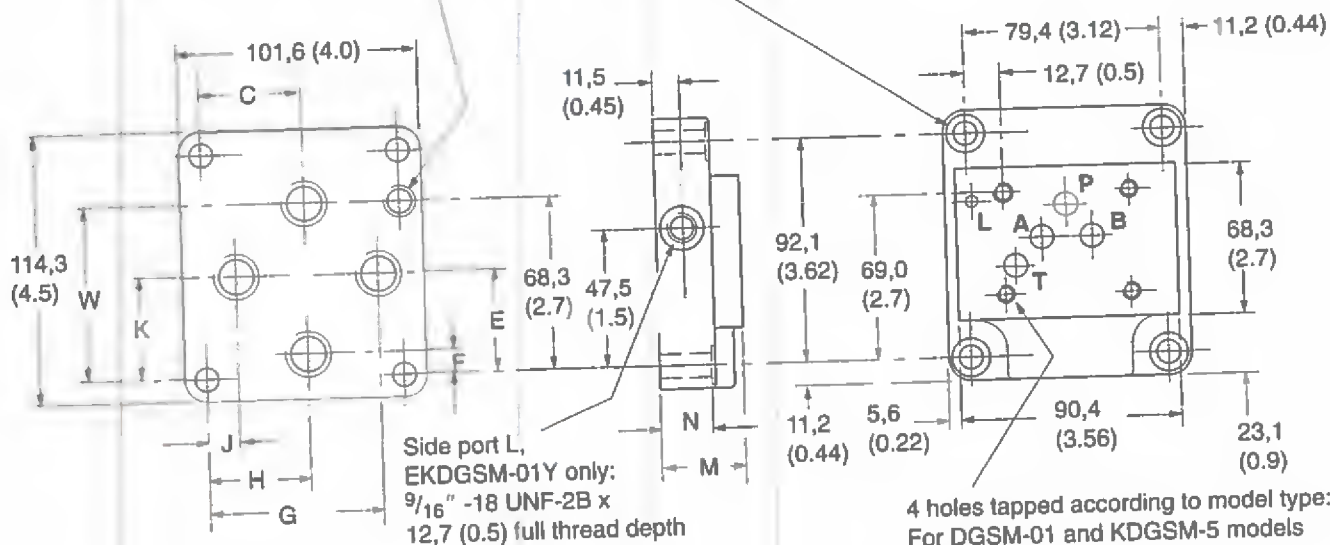
Subplates with Rear Ports P, T, A, B  
Maximum Pressure 210 bar (3000 psi)

Model types: KD GSM-5-676805-2\*  
(with rear port L)  
EKD GSM-01Y-1\*-R  
(with side port L)

Rear port L, KD GSM-5-676805 only:  
G 1/8 (1/8" BSPF) x 12,0 (0.47) full thread depth



4 holes Ø 10,8 (0.42 dia) through,  
spotfaced Ø 17,5 (0.66 dia)



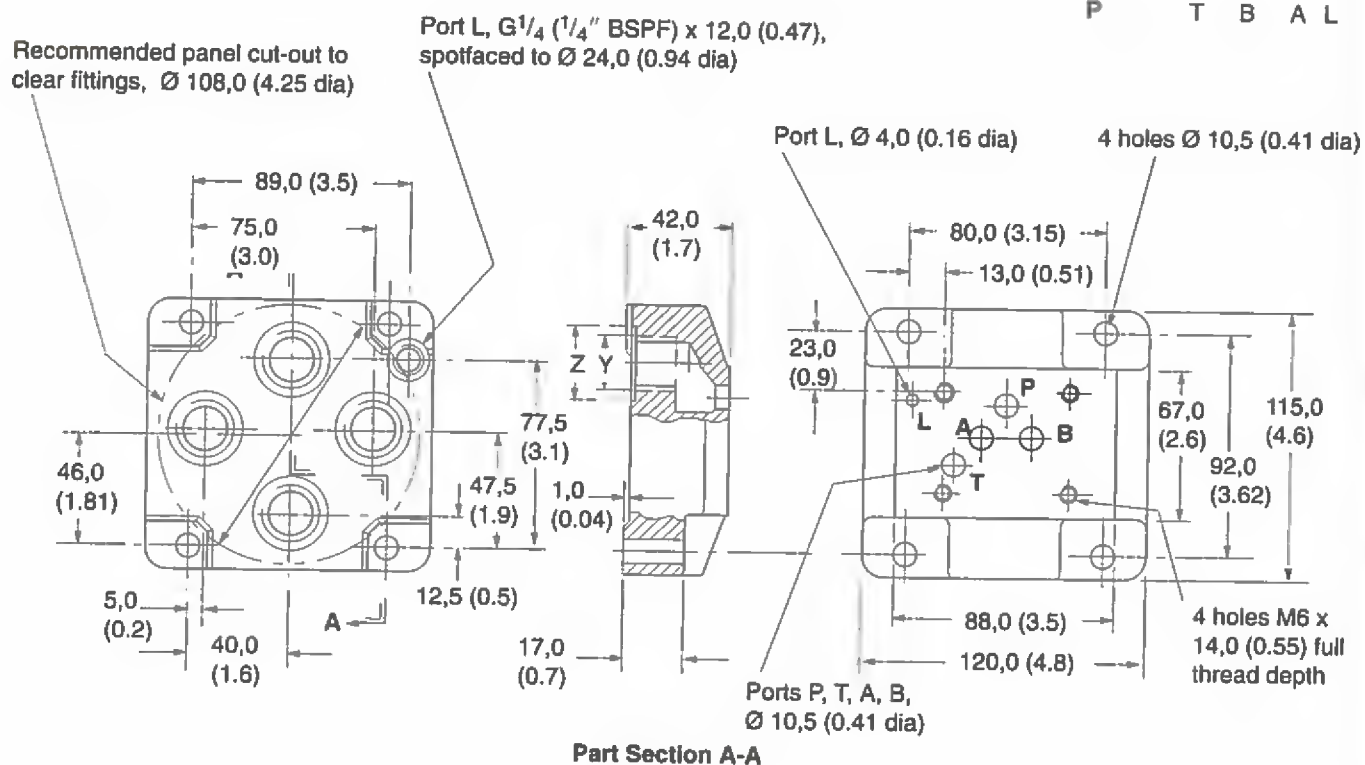
4 holes tapped according to model type:  
For DGSM-01 and KD GSM-5 models  
(UNC port threads),  
1/4" -20 UNC-2B x 12,7 (0.5) deep.  
For ED GSM-01(\*) and EKD GSM-01Y  
models (BSPF port threads),  
M6 x 15,8 (0.62) deep.

Ports P, T, A, B Threads	Ports P, T, A, B Threads
Model	Port thread
210 bar (3000 psi) KD GSM-5-676805-2*	3/4" -16 UNF-2B x 14,0 (0.56) full thread depth
280 bar (4000 psi) EKD GSM-01Y-10-R	G 1/2 (1/2" BSPF) X 15,0 (0.59) full thread depth

Dimensions										
Model	C	E	F	G	H	J	K	M	N	W
210 bar (3000 psi) KD GSM-5-676805-2*	45,2 (1.78)	42,1 (1.66)	19,0 (0.75)	68,3 (2.69)	45,2 (1.78)	23,8 (0.94)	42,1 (1.7)	31,8 (1.25)	23,9 (0.94)	57,1 (2.25)
280 bar (4000 psi) EKD GSM-01Y-1*-R	39,7 (1.56)	40,5 (1.59)	9,9 (0.39)	70,6 (2.78)	39,7 (1.56)	10,7 (0.42)	40,5 (1.59)	36,5 (1.44)	28,6 (1.13)	72,6 (2.86)

**Subplates with Rear Ports P, T, A, B, L**  
**Maximum Pressure 315 bar (4500 psi)**  
 Model types: KD GSM-5-615225-1\*  
 KD GSM-5-615226-1\*

All dimensions in mm (inches)

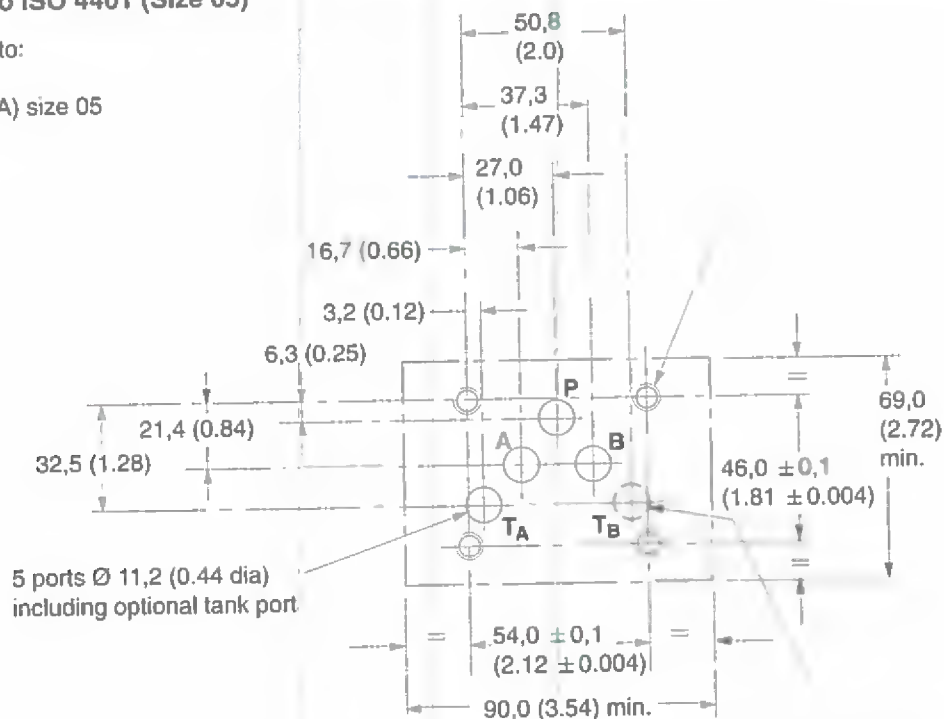


#### Ports P, T, A, B

Model	Y Thread	Z diameter
KD GSM-5-615225-10	G1/2 (1/2" BSPF) x 14,0 (0.55) full thread depth	30,0 (1.18)
KD GSM-5-615226-10	G3/4 (3/4" BSPF) X 16,0 (0.63) full thread depth	33,0 (1.30)

## Mounting Surfaces to ISO 4401 (Size 05)

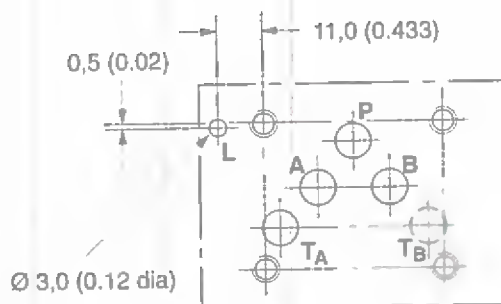
This interface conforms to:  
 ISO 4401-05-04-0-94  
 ANSI/B93.7M (and NFPA) size 05  
 CETOP R35H4.2-05  
 DIN 24340 Form A10



## Interface with Additional Drain Port

The interface conforms to Vickers standard, plus hole "L"

Typically used for proportional and other valves requiring an additional drain port, e.g.:  
 K(B)FDG4V-5  
 K(B)FTG4V-5



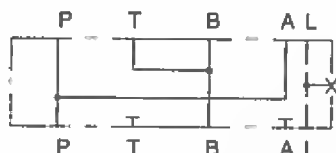
# Parallel Path Flow Module

## Size 05 Parallel-Flow-Path Modules

KDGMA-5-616877-1\*-R

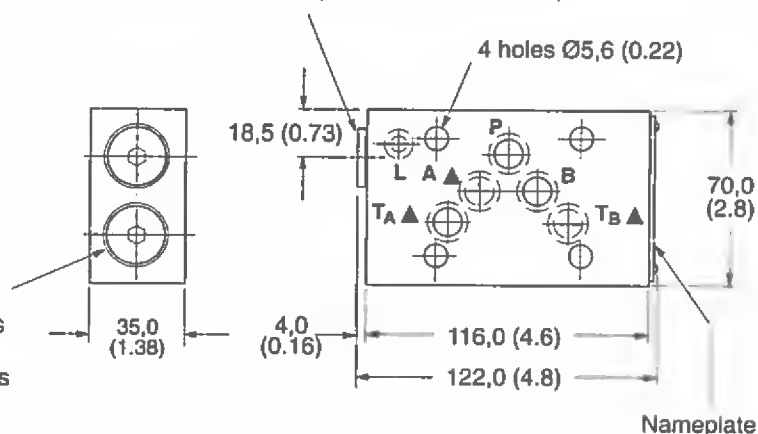
KDGMA-5-02-139150-1\*-S

Supplied with port L plugged. Remove plug for external drain connection if required.  
(See table for tapping and socket A/F sizes)



Typically used for doubling effective flow capability of single solenoid proportional valves (throttle valves), as illustrated in "Typical Applications".

Do not remove this closure plug, or others in side faces



▲ A, T<sub>A</sub> and T<sub>B</sub> ports at subplate face are blind holes fitted with O-seals.

Model	Port L thread	Socket wrench A/F for plug removal	Mass (approx.)
KDGMA-5-616877-1*-R	G1/4 (1/4" BSPF) x 11,0 (0.43) full thread depth	6,0 (0.23)	1,5 kg (3.3 lb)
KDGMA-5-02-139150-1*-S	9/16"-18 UNF x 12,7 (0.5) full thread depth	6,3 (0.25)	1,5 kg (3.3 lb)

## Max. Pressures and Flow Ratings

No functional limitations; dependent on valves used.

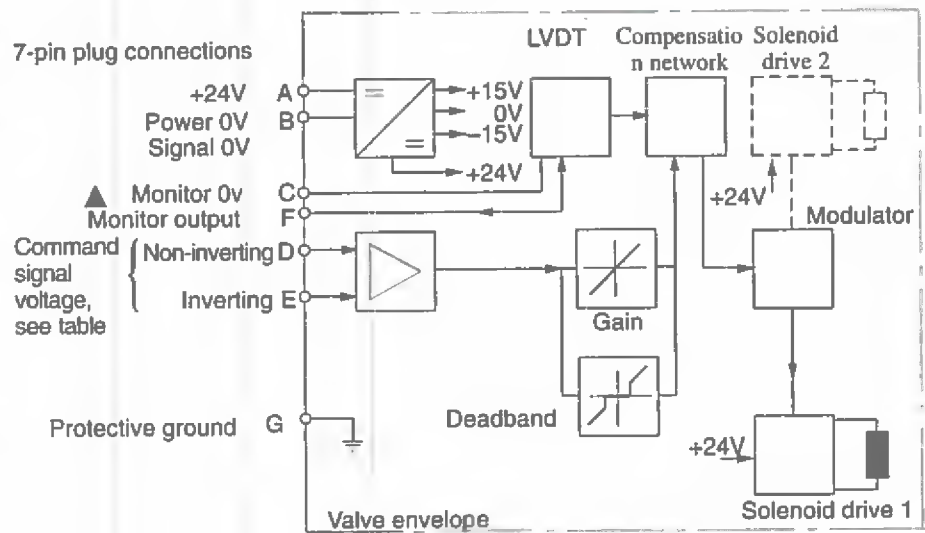


# Electrical Information

## Electrical Block Diagram

KBFDG4V-5 and KBFTG4V-5  
Command Signals and Outputs

7-pin plug		Flow direction
Pin D	Pin E	
Positive	0V	P to A
0V	Negative	
$U_D - U_E =$ Positive		P to B
Negative	0V	
0V	Positive	
$U_D - U_E =$ Negative		



▲ Note: In valves with PH7 or PR7 type electrical connection, pin C is used for a valve enable signal

### Wiring

Connections must be made via the 7-pin plug mounted on the amplifier. See page B.87 of this leaflet and Installation Wiring Practices for Vickers Electronic Products, leaflet 2468. Recommended cable sizes are:

#### Power cables:

For 24V supply  
0,75 mm<sup>2</sup> (18 AWG) up to 20m (65 ft)  
1,00 mm<sup>2</sup> (16 AWG) up to 40m (130 ft)

#### Signal cables:

0,50 mm<sup>2</sup> (20 AWG)

#### Screen (shield):

A suitable cable would have 7 cores, a separate screen for the signal wires and an overall screen.  
Cable outside diameter 8,0–10,5 mm (0.31–0.41 inches)  
See connection diagram on next page.

### KFDG4V-5 and KFTG4V-5

#### Wiring

Wiring details for these valves are contained in the appropriate Eurocard literature and the Installation Wiring Practices for Vickers Electronic Products leaflet 2468.

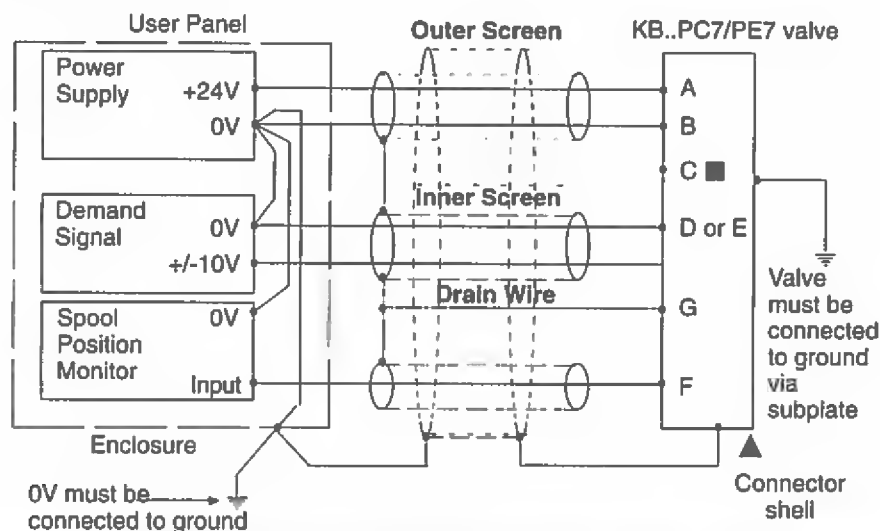


#### Warning

All power must be switched off before connecting or disconnecting any plugs.

# Typical Connection Arrangements

## Wiring Connections



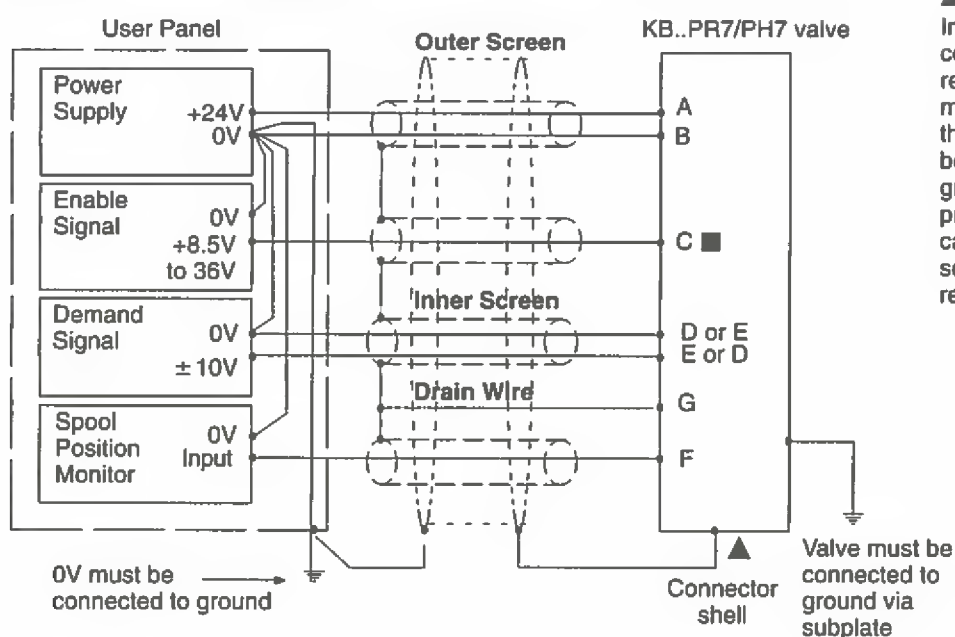
■ Spool position monitor voltage (pin F) will be referenced to the KB valve local ground. A "local ground" (pin C) is provided on PC7/PE7 versions for optional use by differential input customer supplied electronics.



### WARNING

Do not ground pin C. If the local ground (pin C) is not used for differential monitor electronics, do not use. Read monitor pin F with respect to ground.

## Wiring Connections for Valves with Enable Feature



### ▲ Note:

In applications where the valve must conform to European RFI/EMC regulations, the outer screen (shield) must be connected to the outer shell of the 7 pin connector, and the valve body must be fastened to the earth ground. Proper earth grounding practices must be observed in this case, as any differences in command source and valve ground potentials will result in a screen (shield) ground loop.



### Warning

#### Electromagnetic Compatibility (EMC)

It is necessary to ensure that the valve is wired up as above. For effective protection the user electrical cabinet, the valve subplate or manifold and the cable screens should be connected to efficient ground points. The metal 7 pin connector part no. 934939 should be used for the integral amplifier.

In all cases both valve and cable should be kept as far away as possible from any sources of electromagnetic radiation such as cables carrying heavy current, relays and certain kinds of portable radio transmitters, etc. Difficult environments could mean that extra screening may be necessary to avoid the interference.

It is important to connect the 0V lines as shown above. The multi-core cable should have at least two screens to separate the demand signal and monitor output from the power lines.

The enable line to pin C should be outside the screen which contains the demand signal cables.

# Application Data

## Fluid Cleanliness

Proper fluid condition is essential for long and satisfactory life of hydraulic components and systems. Hydraulic fluid must have the correct balance of cleanliness, materials and additives for protection against wear of components, elevated viscosity and inclusion of air.

Recommendations on contamination control methods and the selection of products to control fluid condition are included in Vickers publication 9132 or 561, "Vickers Guide to Systemic Contamination Control". The book also includes information on the Vickers concept of "ProActive Maintenance". The following recommendations are based on ISO cleanliness levels at 2 µm, 5 µm and 15 µm.

For products in this catalog the recommended levels are:

0 to 70 bar (1000 psi) ..... 18/16/13  
70 + bar (1000 + psi) ..... 17/15/12

Vickers products, as any components, will operate with apparent satisfaction in fluids with higher cleanliness codes than those described. Other manufacturers will often recommend levels above those specified.

Experience has shown, however, that life of any hydraulic components is shortened in fluids with higher cleanliness codes than those listed above. These codes have been proven to provide a long trouble-free service life for the products shown, regardless of the manufacturer.

## Hydraulic Fluids

Materials and seals used in these valves are compatible with antiwear hydraulic oils, and non-alkyl-based phosphate esters. The extreme operating viscosity range is 500 to 13 cSt (2270 to 70 SUS) but the recommended running range is 54 to 13 cSt (245 to 70 SUS). For further technical information about fluids see "Technical Information" leaflet B-920 or I-286S.

## Installation

The proportional valves in this catalog can be mounted in any attitude, but it may be necessary in certain demanding applications, to ensure that the solenoids are kept full of hydraulic fluid. Good installation practice dictates that the tank port and any drain port are piped so as to keep the valves full of fluid once the system start-up has been completed.

## Mounting Bolt Kits

For K(B)FD/TG4V-5

BKDG01633M (metric)

BK869705 (inch)

*If not using Vickers recommended bolt kits, bolts used should be to ISO 898, 12.9 or better.*

## Seal Kits

KFD/TG4V-5 ..... 565110

KBFD/TG4V-5-1\* ..... 02-332751

## Plugs

KBFDG4V

7-pin plug (metal) ..... 934939

7-pin plug (plastic) ..... 694534  
(metal plug must be used for full EMC protection)

**NOTE:** An alternative metal connector which gives EMC protection but not IP67 rating is available from ITT-Cannon, part number CA02-COM-E-14S-A7-P.

KFDG4V

Solenoid (black) ..... 710775

Solenoid (gray) ..... 710776

LVDT (gray) ..... 458939

## Extension Cable

**Extension Cable:** Adapter for extending 7 core cable when changing from KA to KB valve and existing wiring is not long enough. Consists of a 7 pin plug, a 7 pin socket and a length of cable, fully assembled for ease of use

Extension Cable ..... 944450

## Service Information

The products from this range are preset at the factory for optimum performance; disassembling critical items would destroy these settings. It is therefore recommended that should any mechanical or electronic repair be necessary they should be returned to the nearest Vickers repair center. The products will be refurbished as necessary and retested to specification before return.

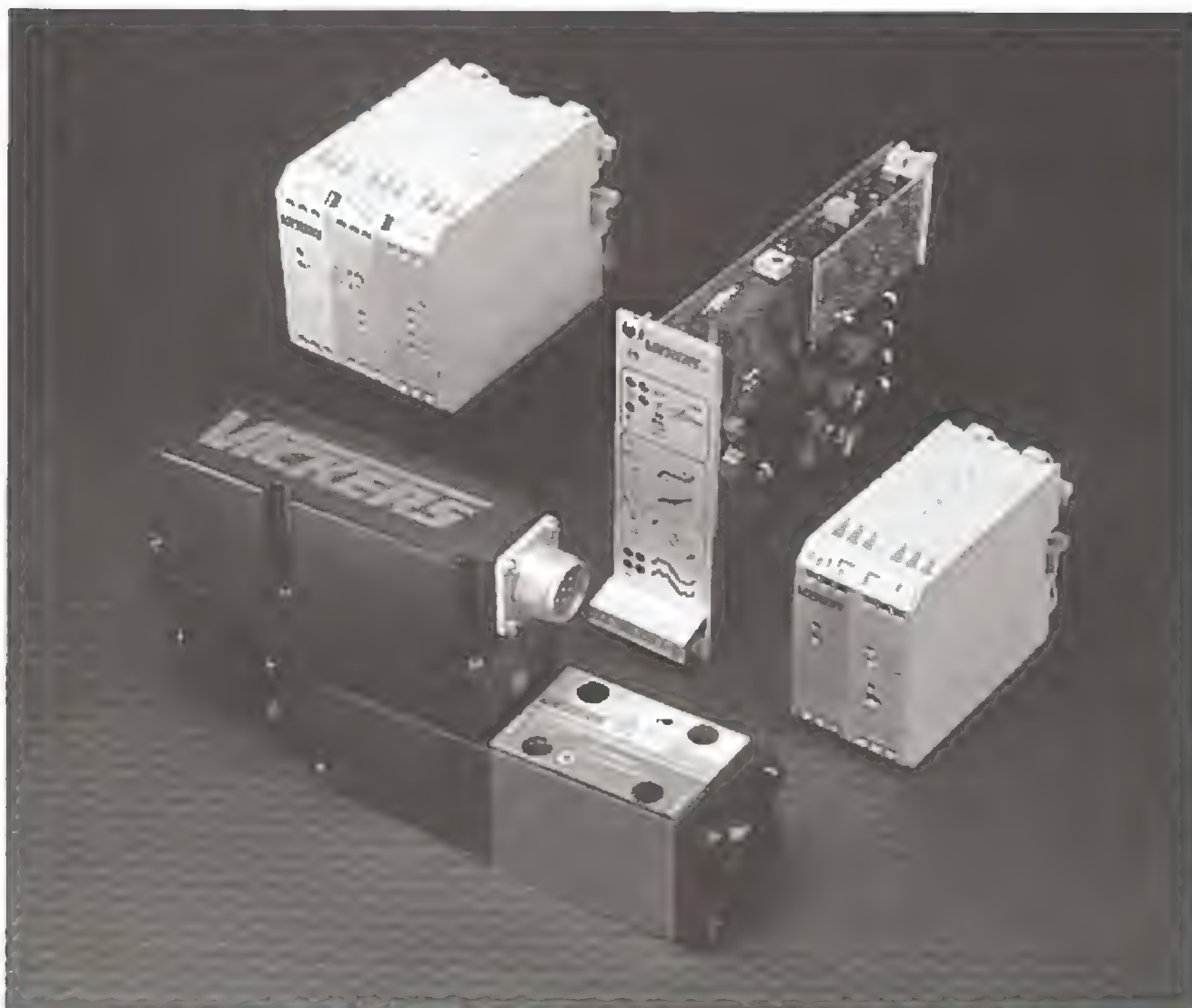
Field repair is restricted to the replacement of the seals.


*Note: The feedback/solenoid assembly installed in this valve should not be disassembled.*

## Proportional Directional Valves with Feedback

K(B)SDG4V-3, 1\* Series

Pressures to 350 bar (5075 psi)



*This product has been designed and tested to meet specific standards outlined in the European Electromagnetic Compatibility Directive (EMC) 89/336/EEC, amended by 91/263/EEC, 92/31/EEC and 93/68/EEC, article 5. For instructions on installation requirements to achieve effective protection levels, see this leaflet and the Installation Wiring Practices for Vickers Electronic Products leaflet 2468. Wiring practices relevant to this Directive are indicated by  Electromagnetic Compatibility (EMC).*

5071.02/EN/1197/A

# Introduction

## General Description

These four-way solenoid operated proportional valves have a high dynamic performance which enables them to be used in closed-loop applications, previously possible only with servo valves. Various spool options are available for rated flows up to 40 L/min (10.6 USgpm). Working pressures are to 350 bar (5000 psi). The spool position is monitored by an LVDT which feeds back information to the amplifier, enabling spool position to be accurately maintained. This valve type can be supplied with or without an integral amplifier built directly onto the valve.

### KSDG4V-3

*Without the integral amplifier.*

#### Features and Benefits

- Wide range of spool and flow rate options.
- Supported by a broad range of amplifiers and auxiliary function modules.

- Electronic feedback LVDT ensures accurate spool position control.
- Internal current feedback provides optimal control.
- Vibration and shock tested.
- Full CE electromagnetic compatibility.

### KBSDG4V-3

*With integral control electronics.*

Factory-set adjustments of gain, spool deadband compensation and offset ensure consistent repeatability valve-to-valve.

The only electrical inputs required are power supply (24V) and a voltage command signal of  $\pm 10V$ . The amplifier is housed in a robust metal enclosure, sealed against ingress of water and other fluids. Electrical connections are via a standard 7-pin plug.

A spool position monitor pin allows the function of the valve to be electrically monitored. Ramp functions, if required, can be generated externally.

#### Features and Benefits

- Factory-sealed adjustments ensure valve-to-valve reproducibility
- Installation wiring reduced and simplified.
- Standard 7-pin connector.
- Standard 24V DC supply with wide tolerance band.
- Standard  $\pm 10 V$  DC command signals.
- Valve with integrated amplifier selected, ordered, delivered and installed as one performance-tested package.
- Spool position monitor pin to help with troubleshooting.
- Simple valve removal and replacement for service (plug & play).
- Vibration and shock tested.
- Auxiliary DIN rail mounted electronic function modules available.
- Full CE electromagnetic compatibility.
- IP67 valve, environmental protection rating.
- Optional valve enable function.

# Contents

Introduction .....	B.90
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Functional Symbols .....	B.92
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Pressures and Flow Rates .....	B.94
Performance Curves .....	B.94
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Subplates and Mounting Surfaces .....	B.97
Electrical Information .....	B.98
Application Data .....	B.100



# Model Codes

**K (B) S D G 4 V - 3 - 9 \* L - \*\* - M - U1 - \*\* - H 7 - 1\***  
 [1] [2] [3] [4] [5] [6] [7] [8] [9] [10] [11] [12] [13] [14] [15] [16] [17] [18]

## [1] Valve type

**K** – Proportional valve

## [2] Integral amplifier

**B** – Integral amplifier “B” series  
Omit for models without integrated amplifiers.

## [3] Feedback arrangement

**S** – Closed-loop

## [4] Control type

**D** – Directional valve

## [5] Mounting

**G** – Subplate mounted

## [6] Operation

**4** – Solenoid operated

## [7] Pressure rating

**V** – >250 bar (3625 psi) on ports  
P, A, & B

## [8] Interface

**3** – ISO 4401, size 03-02-0-94  
ANSI/B93.7M-D03

## [9] Spool type (center condition)

**9** – Zero lap (biased underlap)

## [10] Spool type, spring offset condition

**2** – Ports P, A, & T blocked  
**6** – Port P blocked, A & B to tank

## [11] Valve build

**L** – Standard build

## [12] Rated flow at 70 bar (1000 psi) loop $\Delta p$ pressure drop

**05** – 5 L/min (1.3 USgpm)  
**12** – 12 L/min (3.2 USgpm)  
**24** – 24 L/min (6.3 USgpm)  
**40** – 40 L/min (10.6 USgpm)

For actual maximum flow refer to Power capacity envelope curves, page B.95.

## [13] LVDT plug

(omit for valves with integral amplifier)  
**M** – Standard LVDT (mating plug supplied)

## [14] Solenoid connector

(omit for valves with integral amplifier)  
**U1** – ISO 4400/DIN 43650, non-integral amplifier type only (mating plugs supplied)

## [15] Electrical connection (KBS valves only)

**PC7** – 7 pin connector without plug  
**PE7** – 7 pin electrical plug with mating half  
**PH7** – As PE7 but with pin “C” used for enable signal  
**PR7** – As PC7 but with pin “C” used for enable signal

## [16] Coil rating

**H** – 24 VDC amplifier supply

## [17] Port T pressure limit code

**7** – for all spools

## [18] Design number

**1\*** series. Subject to change

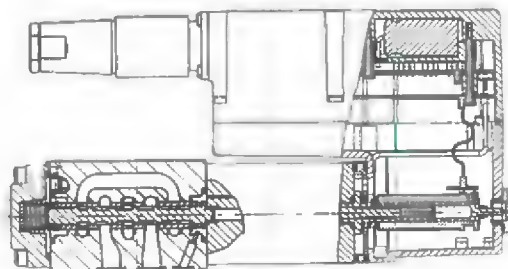


### Warning

Valves with integral amplifiers are supplied with or without the metal 7-pin plug. The Vickers plug, part no. 934939, must be correctly fitted to ensure that the EMC rating and IP67 rating are achieved. The plug retaining nut must be tightened with a torque of 2-2,0 Nm (1.5-2.5 lbf ft) to effect a proper seal.



## Typical Section View



KBSDG4V-3

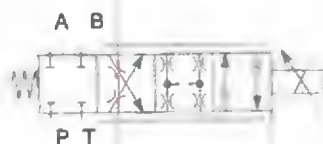
## Spool Symbols

Available Spools for K(B)SDG4V-3

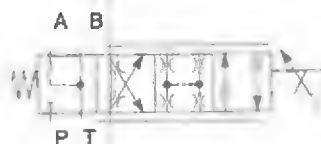
### Spool Types and Flow Ratings

#### Symmetric Spools

Base line starting at  $\Delta p = 5$  bar (75 psi) per metering flow path, e.g. B to T. For actual maximum flow refer to power capacity envelope curves.



Spool type 92L



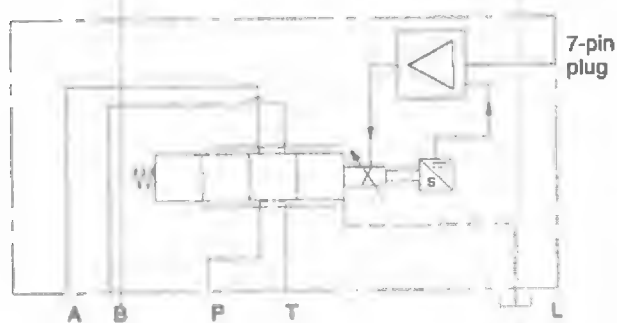
Spool type 96L

Spool code	Spool symbol	Flow rating
For K(B)SDG4V-3 valves:		
92L05	92L	5 L/min (1.3 USgpm)
92L12	92L	12 L/min (3.2 USgpm)
92L24	92L	24 L/min (6.3 USgpm)
92L40	92L	40 L/min (10.6 USgpm)
96L05	96L	5 L/min (1.3 USgpm)
96L12	96L	12 L/min (3.2 USgpm)
96L24	96L	24 L/min (6.3 USgpm)
96L40	96L	40 L/min (10.6 USgpm)

## Functional Symbols

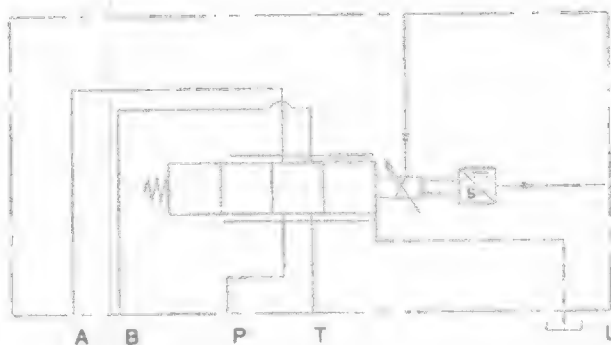
### Model Types KBSDG4V-3

proportional directional valve (with integral electronics)



### Model Types KSDG4V-3

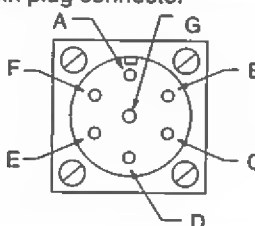
proportional directional valve (requires amplifier card)



# Operating data

## Valves with integrated amplifier

**KBSDG4V-3 Valves with Integral amplifier:** Data is typical: With fluid at 36 cSt (168 SUS) and 50°C (122°F).

Power supply	24V DC (21V to 36V including 10% peak-to-peak max. ripple) max current 3A																		
Command signal	0 to +10V DC, or 0 to -10V DC, or -10 V to +10 V DC																		
Input impedance	47 kΩ																		
Common mode voltage to pin B	18V (max)																		
Valve enable signal for model code PH7																			
Enable	>8.5V (36V max)																		
Disable	<6.5V																		
Input impedance	10 kΩ																		
7-pin plug connector	<table> <tr> <th>Pin</th><th>Description</th></tr> <tr> <td>A</td><td>Power supply positive (+)</td></tr> <tr> <td>B</td><td>Power 0V</td></tr> <tr> <td>C</td><td>Command/Monitor 0V (PE7 &amp; PC7)</td></tr> <tr> <td>C</td><td>Valve enable (PH7 &amp; PR7)</td></tr> <tr> <td>D</td><td>Command signal (+)-non-inverting input</td></tr> <tr> <td>E</td><td>Command signal (-)-inverting input</td></tr> <tr> <td>F</td><td>Monitor input</td></tr> <tr> <td>G</td><td>Protective ground</td></tr> </table>	Pin	Description	A	Power supply positive (+)	B	Power 0V	C	Command/Monitor 0V (PE7 & PC7)	C	Valve enable (PH7 & PR7)	D	Command signal (+)-non-inverting input	E	Command signal (-)-inverting input	F	Monitor input	G	Protective ground
Pin	Description																		
A	Power supply positive (+)																		
B	Power 0V																		
C	Command/Monitor 0V (PE7 & PC7)																		
C	Valve enable (PH7 & PR7)																		
D	Command signal (+)-non-inverting input																		
E	Command signal (-)-inverting input																		
F	Monitor input																		
G	Protective ground																		
 <p>View of pins of fixed half.</p>																			
Electromagnetic compatibility (EMC):																			
Emission (10 V/m)	EN 50081-2																		
Immunity (10 V/m)	EN 50082-2																		
Zero adjustment	± 18% mechanical adjustment accessible under plug in LVDT																		
Monitor point signal	± 10 V DC for full spool stroke																		
Output impedance	10kΩ																		
Power stage PWM frequency	10 kHz nominal																		
Reproducibility, valve-to-valve (at factory settings):																			
Flow gain at 100% command signal	≤ 5%																		
Protection:																			
Electrical	Reverse polarity protected																		
Mechanical	IEC 144, Class IP67																		
Relative humidity	85 to 95% at 20 to 70°C (68 to 158°F)																		
Ambient air temperature range for full performance	0° C to 70° C (32° F to 158° F)																		
Oil temperature range for full performance	0° C to 70° C (32° F to 158° F)																		
Minimum temperature at which valves will work at reduced performance	-20° C (-4° F)																		
Storage temperature range	-25° C to +85° C (-13° F to +185° F)																		
Supporting products:																			
Auxiliary electronic modules (DIN-rail mounting):																			
EHA-CON-201-A2* signal converter	See catalog GB 2410A																		
EHD-DSG-201-A-1* command signal generator	See catalog GB 2470																		
EHA-RMP-201-A-2* ramp generator	See catalog GB 2410A																		
EHA-PID-201-A-2* PID controller	See catalog GB 2427																		
EHA-PSU-201-A-10 power supply	See catalog GB 2410A																		

**KSDG4V-3 Valves without integral amplifier (requires a Eurocard amplifier, refer to Supporting Products)**

Standing current at null	1,7 A
Max current, at 50° C (122° F) ambient	3,2 A
Coil resistance, at 20° C (68° F)	1,87Ω
Coil inductance, at 1000 Hz & 150 mV	7.2 mH

# Operating data

## Valves w/o integrated amplifier

### KSDG4V-3 Valves without Integral amplifier(continued)

Max solenoid power	30W
LVDT supply voltage	+15V DC
LVDT output signal	4 to 20 mA for spool stroke of 2,1 mm
Electromagnetic compatibility (EMC)	
Emission (10V/m)	EN 50081-2
Immunity (10V/m)	EN 50082-2
Base amplifier	EEA-PAM-553-A-3* Power requirements: 20 to 40V DC at 40W
Mechanical protection	IEC 144, Class IP65
Maximum allowable ambient air temperature	60° C (140° F)
Maximum allowable oil temperature	60° C (140° F)

### KSDG4V-3 and KBSD/TG4V-3 Valves (all valves)

Relative duty factor	Continuous rating (ED = 100%)
Hysteresis	< 0.5%
Step response:	
Step size (% of max spool stroke):	Time to reach 90% of required step:
0 to 100% or 100 to 0%	10 ms
10 to 90% or 90 to 10%	8 ms
25 to 75% or 75 to 25%	6 ms
+90 to -90%	12 ms
Mass:	
KSDG4V-3	2,09 kg (4.6 lb) approx.
KBSDG4V-3	2,49 kg (5.5 lb) approx.

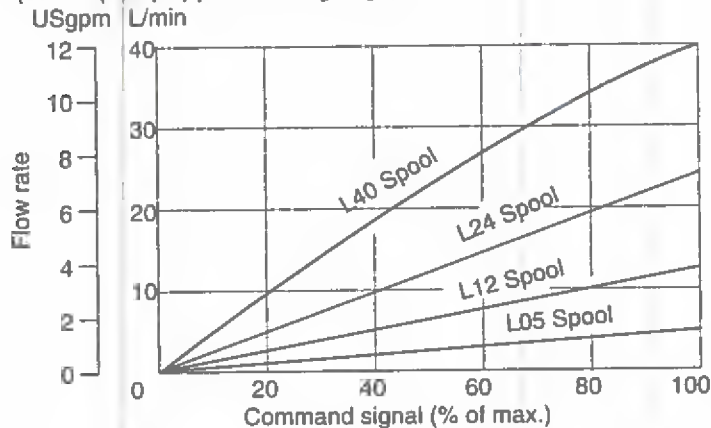
### Pressures and Flow Rates Maximum pressures, bar (psi)

Port L condition	Ports P, A, B	T	L
Normally blocked by mounting surface	350 (5000)	50 (720)	50 (720)
Drained directly to tank	350 (5000)	210 (3000)	10 (145)

### Performance Curves

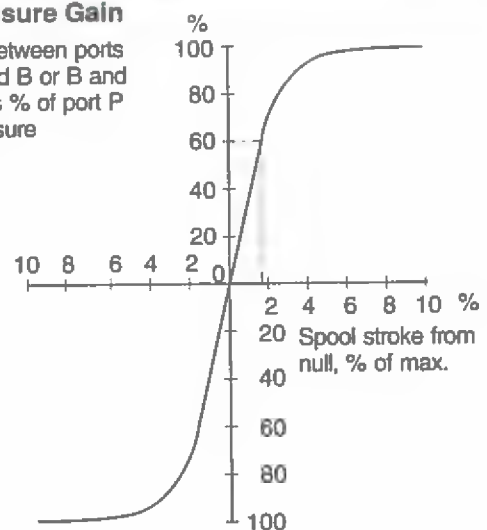
#### Flow Gain

Flow from port P-A-B-T or P-B-A-T at  
70 bar (1000 psi) total valve  $\Delta p$   
(35 bar (500 psi) per metering edge)



#### Pressure Gain

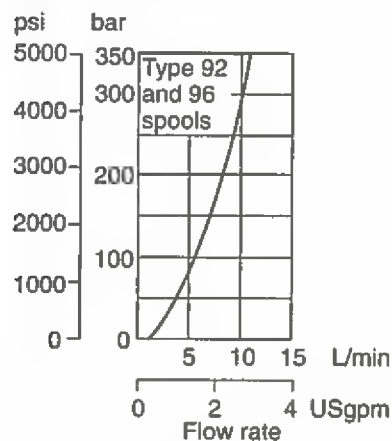
$\Delta p$  between ports  
A and B or B and  
A, as % of port P  
pressure



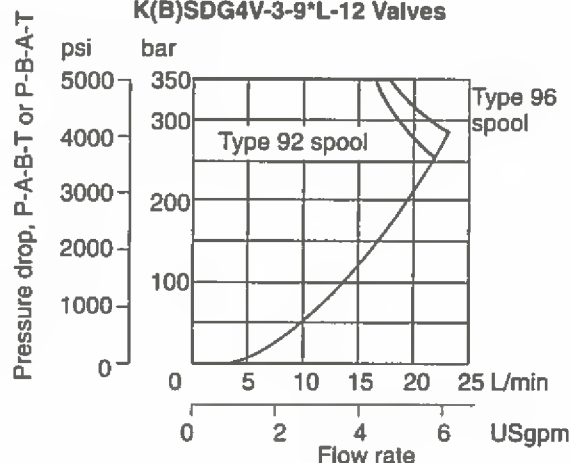
# Performance Curves

## Power Capacity Envelopes

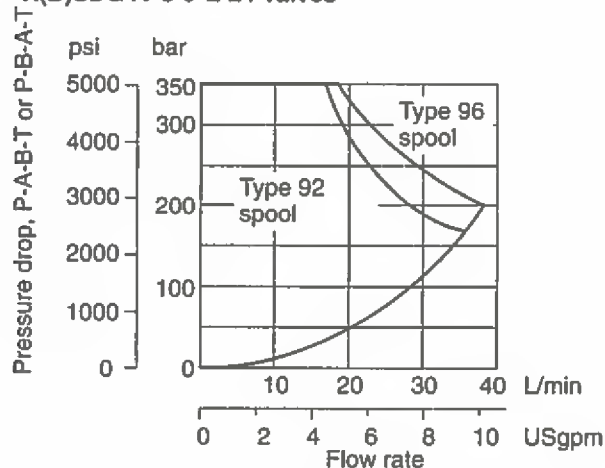
K(B)SDG4V-3-9\*L-05 Valves



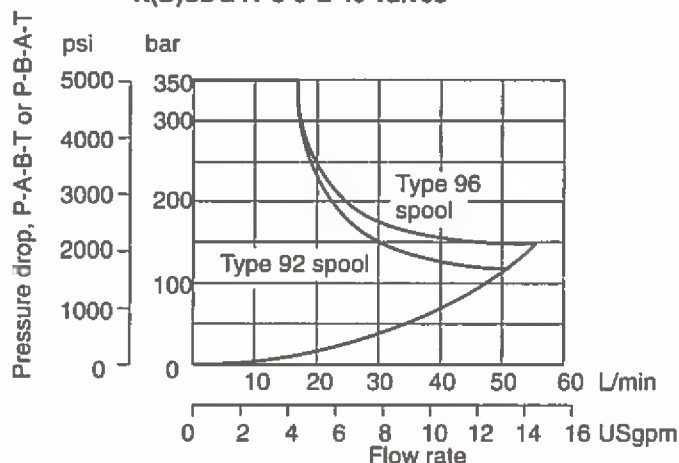
K(B)SDG4V-3-9\*L-12 Valves



K(B)SDG4V-3-9\*L-24 Valves

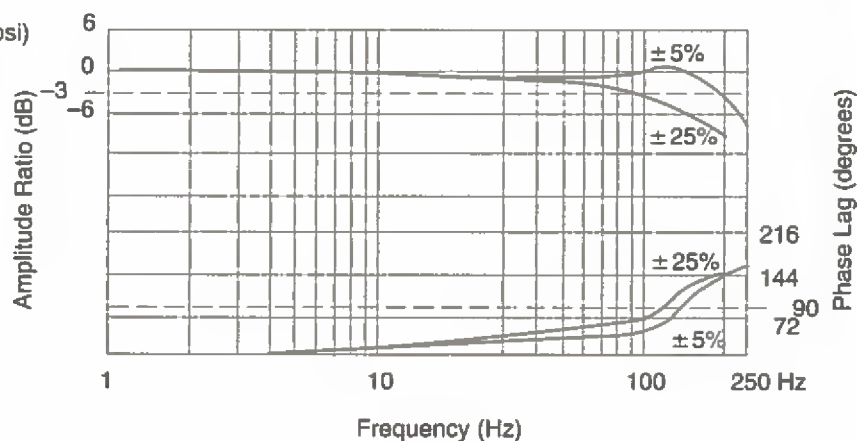


K(B)SDG4V-3-9\*L-40 Valves



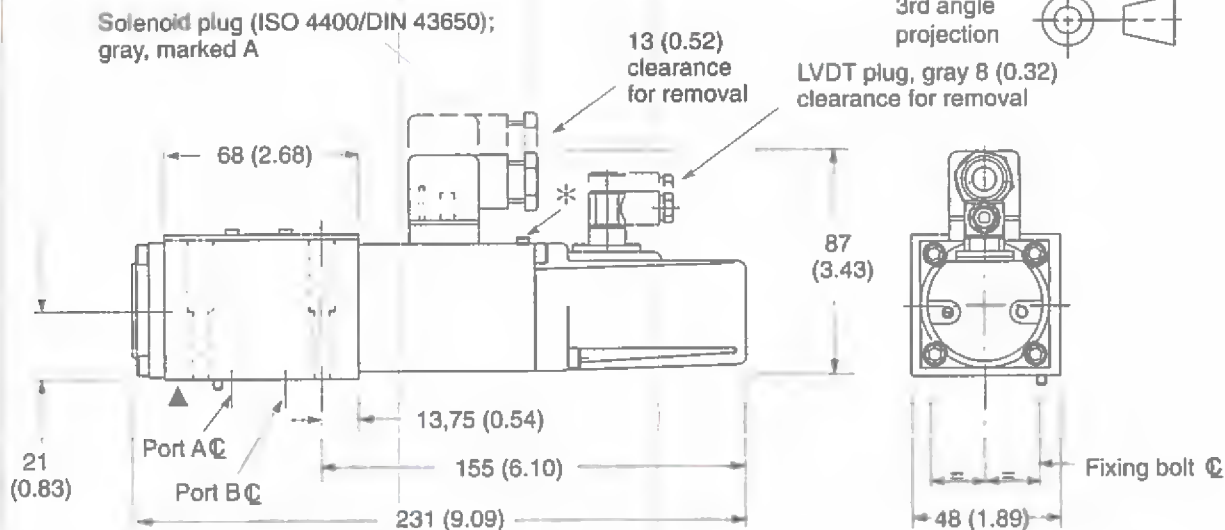
## Frequency Response

Typical for amplitudes of  $\pm 5\%$ ,  $\pm 25\%$  with zero offset.  $\Delta p$  (P to T)=70 bar (1000 psi)

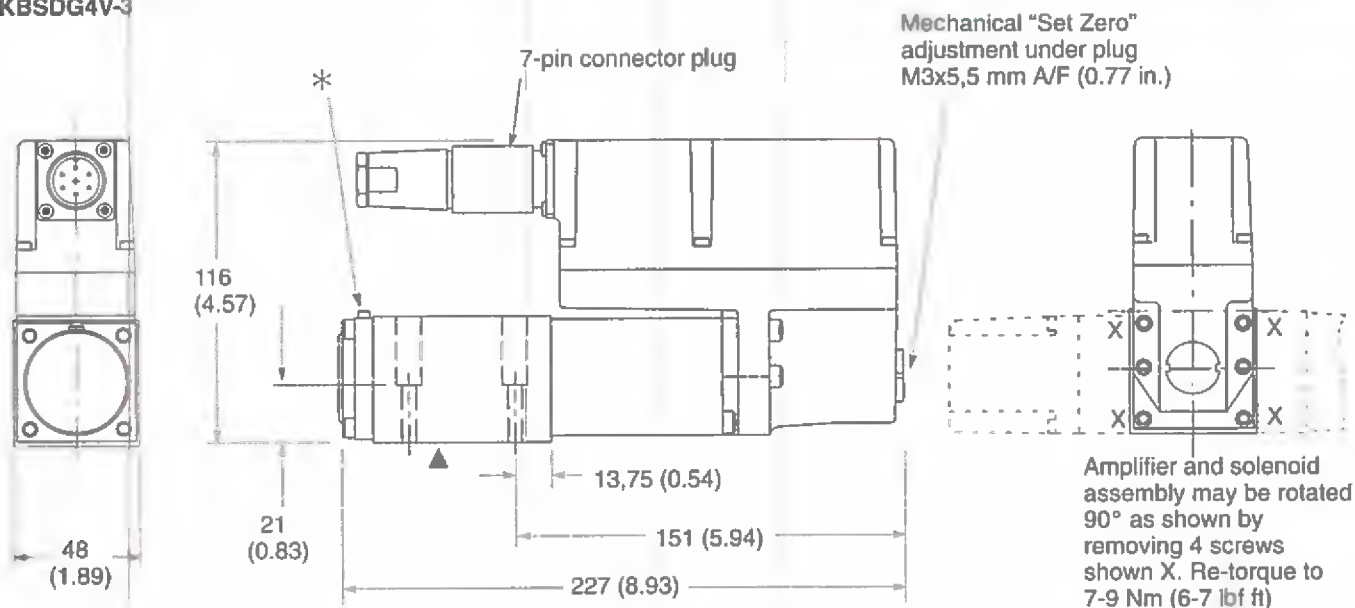


# Installation Dimensions

## KSDG4V-3



## KBSDG4V-3



▲ Mounting surface seals supplied. For mounting surface dimensions and subplate options see page B.97.

\*Note: Bleed screw locations Air bleed, Socket Head Cap Screw. Torque to 2,5-3,0 Nm (2.0-2.5 lbf ft)



### Warning

Valves with integral amplifiers are supplied with or without the metal 7-pin plug. The Vickers plug, part no. 934939, must be correctly fitted to ensure that the EMC rating and IP67 rating are achieved. The plug retaining nut must be tightened with a torque of 2-2,5 Nm (1.5-2.0 lbf ft) to effect a proper seal)



# Subplates and Mounting Surfaces

## General Description

If a subplate is not used, a machined pad must be provided for valve mounting. Pad must be flat within 0,0127 mm (.0005 inch) and smooth within 1,6 µm (63 microinch). Mounting bolts, when provided by customer, should be ISO 898 class 12.9 or better.

## Dimensional Tolerances

Dimensional tolerance on interface drawings is  $\pm 0,2$  mm ( $\pm 0.008$ " ) except where otherwise stated. ISO 4401 specifies inch conversion to  $\pm 0.01$ ".


## Conversion from Metric

ISO 4401 gives dimensions in mm. Inch conversions are accurate to 0.01" unless otherwise stated.

## Mounting Bolt Tappings

ISO 4401 gives metric thread tappings. Alternate UNC tappings are Vickers recommendations that allow these plates and associated valves to be used up to their maximum pressures, when using Vickers recommended bolt kits, or bolts of an equivalent strength. It is recommended that Customer's own manifold blocks for UNC bolts should be tapped to the minimum depths given in the footnotes.

## Subplates

Description and Mass kg (lb)	Functional Symbol	Model Code	Max. Pressure
Single-station subplate; rear ports P, T, A, B; side port L Cast iron 1,3 (2.9)		KDGVM-3-1*-R▲ KDGVM-3-676803-1* (SAE/UNF ports)	250 bar (3600 psi)

\* Design number subject to change. No change of installation dimensions for design numbers 10 to 19 or 21 to 29 inclusive.

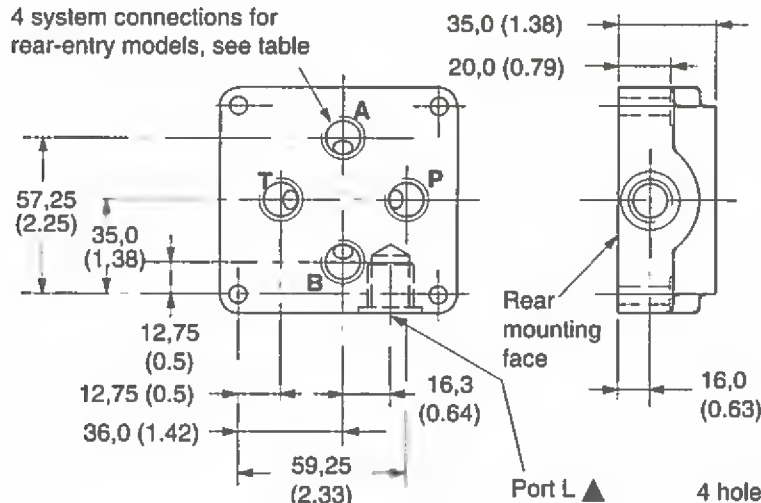
▲ "S" suffix = SAE/UNC ports and/or UNC fixing bolt tappings and/or orifice plugs as appropriate.

"R" or "B" = ISO 228 (BSPF) ports and/or metric fixing bolt tappings and/or orifice plugs as appropriate.

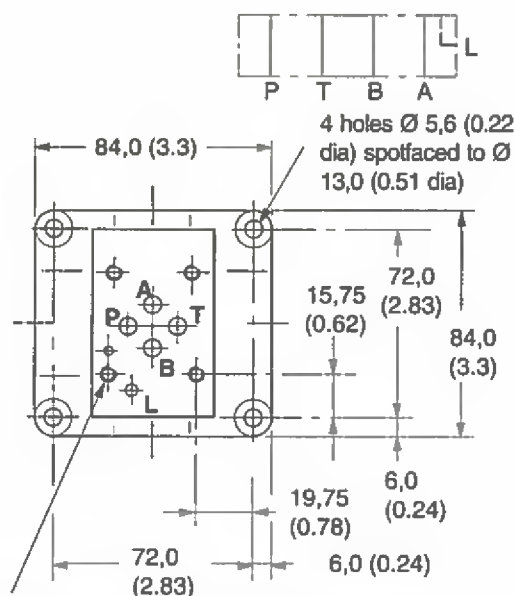
## Installation Dimensions

### Single-Station Subplates, Rear and Side Tapped Ports

4 system connections for rear-entry models, see table



▲ 11,5 (0.45) from rear mounting face to port center line.



4 holes tapped according to model type (see table):  
For models with BSPF ports, M5 x 12 (0.47) deep  
For models with SAE ports, #10-24 UNF-2B x 12,7 (0.5) deep

## Port Threads

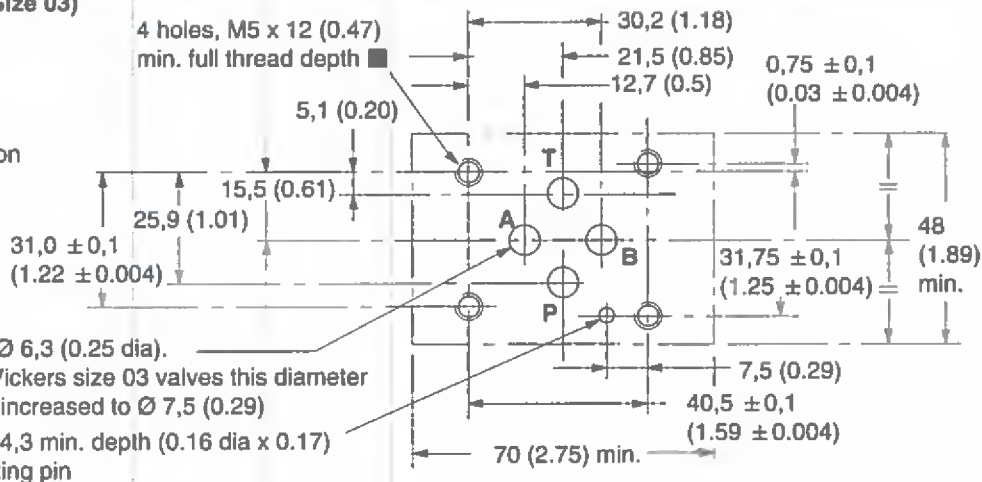
Model	Ports P, T, A, B, at rear or side		Port L
<b>BSPF ports/M5 mounting bolts:</b> KDGVM-3-1*-R	Rear	G <sup>3/8</sup> " (3/8" BSPF) x 12,0 (0.47) deep	G <sup>1/8</sup> " (1/8" BSPF) x 12,0 (0.47) deep
<b>SAE ports/#10-24 UNC mounting bolts:</b> KDGVM-3-676803-1*	Rear	3/4"-16 UNF-2Bx14,3 (0.56) deep (SAE)	7/16"-20 UNF-2B x 11,6 (0.46) deep (SAE)



# Mounting Surface Interface

## Mounting Surfaces to ISO 401 (Size 03)

This interface conforms to:  
ISO 4401-03-02-0-94  
plus location pin hole  
ANSI/B93.7M (and NFPA) size 03  
CETOP R35H4.2-4-03, plus location  
pin hole  
DIN 24340 Form A6 plus location  
pin hole

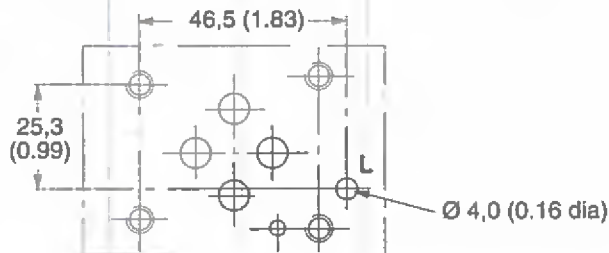


■ #10-24 UNC-2B optional.

## Interface with Additional Drain Port

The interface conforms to Vickers standard, plus hole "L"

Typically used for proportional and other valves requiring an additional drain port.



# Electrical Information

## Block Diagram KBSDG4V-3

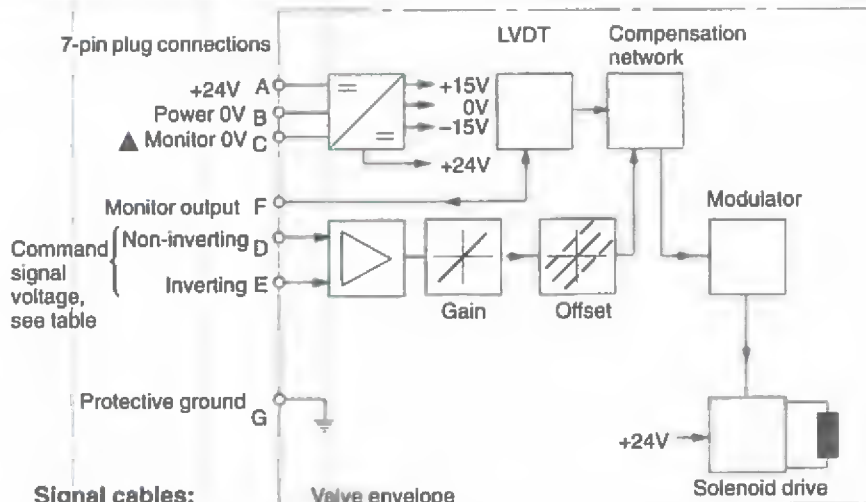
Command Signals and Outputs		Flow direction
7-pin plug	Pin D	
Pin D	Pin E	
Positive	OV	P to A
OV	Negative	
U <sub>D</sub> - U <sub>E</sub>	Positive	P to B
Negative	OV	
OV	Positive	P to B
U <sub>D</sub> - U <sub>E</sub>	Negative	

## KBSDG4V-3 Wiring

Connections must be made via the 7-pin plug mounted on the amplifier. See page B.99 of this leaflet and Installation Wiring Practices for Vickers Electronic Products, leaflet 2468. Recommended cable sizes are:

### Power cables:

For 24V supply  
0,75 mm<sup>2</sup> (18 AWG) up to 20m (65 ft)  
1,00 mm<sup>2</sup> (16 AWG) up to 40m (130 ft)



### Signal cables:

0,50 mm<sup>2</sup> (20 AWG)

### Screen (shield):

A suitable cable would have 7 cores, a separate screen for the signal wires and an overall screen.  
Cable outside diameter 8,0-10,5 mm (0.31-0.41 inches)  
See connection diagram on next page.



### Warning

All power must be switched off before connecting/disconnecting any plugs.

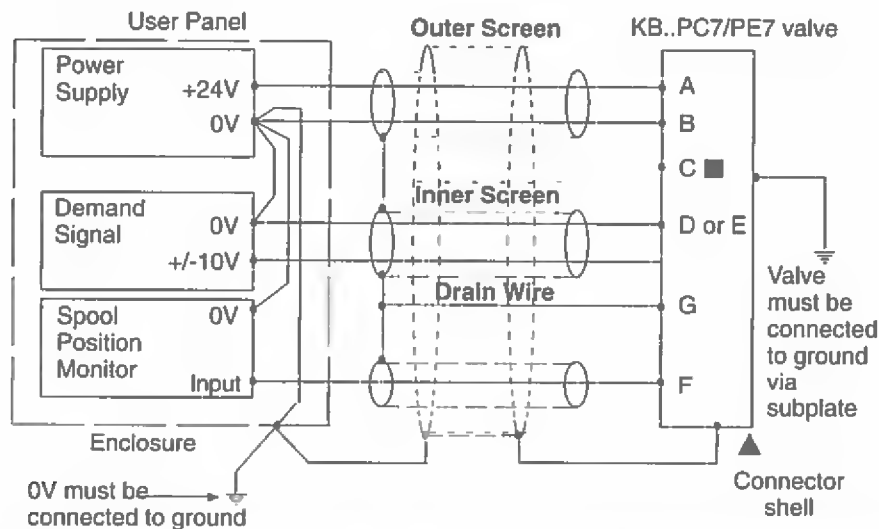
▲ Note: In valves with PH7 or PR7 type electrical connection, pin C is used for a valve enable signal.

## KSDG4V-3 Wiring

Wiring details for these valves are contained in the appropriate Eurocard literature and the Installation Wiring Practices for Vickers Electronic Products leaflet 2468.

# Typical Connection Arrangements

## Wiring Connections



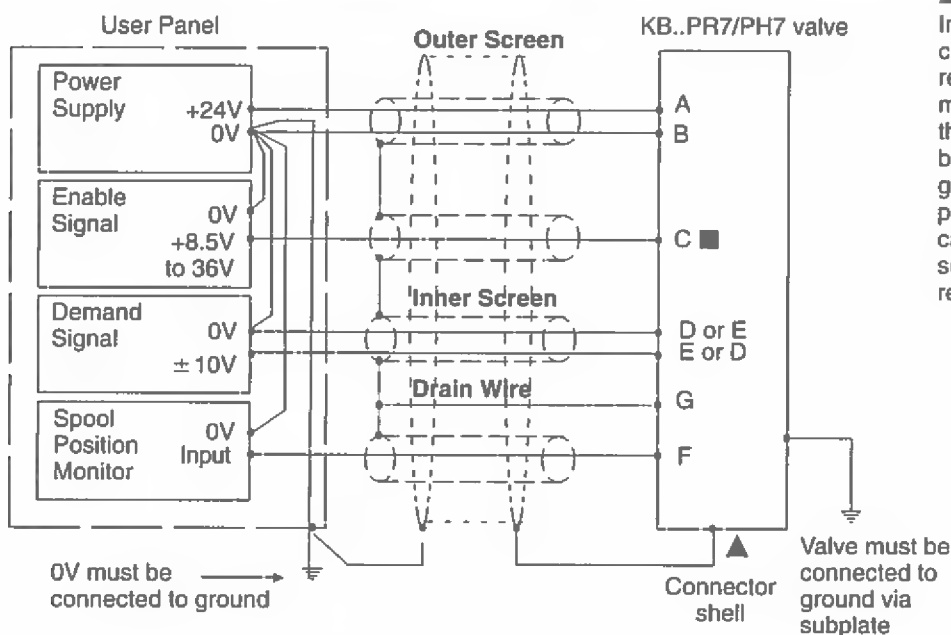
■ Spool position monitor voltage (pin F) will be referenced to the KB valve local ground. A "local ground" (pin C) is provided on PC7/PE7 versions for optional use by differential input customer supplied electronics.



### WARNING

Do not ground pin C. If the local ground (pin C) is not used for differential monitor electronics, do not use. Read monitor pin F with respect to ground.

## Wiring Connections for Valves with Enable Feature



### ▲ Note:

In applications where the valve must conform to European RFI/EMC regulations, the outer screen (shield) must be connected to the outer shell of the 7 pin connector, and the valve body must be fastened to the earth ground. Proper earth grounding practices must be observed in this case, as any differences in command source and valve ground potentials will result in a screen (shield) ground loop.



### Warning

#### Electromagnetic Compatibility (EMC)

It is necessary to ensure that the valve is wired up as above. For effective protection the user electrical cabinet, the valve subplate or manifold and the cable screens should be connected to efficient ground points. The metal 7 pin connector part no. 934939 should be used for the integral amplifier.

In all cases both valve and cable should be kept as far away as possible from any sources of electromagnetic radiation such as cables carrying heavy current, relays and certain kinds of portable radio transmitters, etc. Difficult environments could mean that extra screening may be necessary to avoid the interference.

It is important to connect the 0V lines as shown above. The multi-core cable should have at least two screens to separate the demand signal and monitor output from the power lines.

The enable line to pin C should be outside the screen which contains the demand signal cables.

# Application Data

## Fluid Cleanliness

Proper fluid condition is essential for long and satisfactory life of hydraulic components and systems. Hydraulic fluid must have the correct balance of cleanliness, materials and additives for protection against wear of components, elevated viscosity and inclusion of air.

Recommendations on contamination control methods and the selection of products to control fluid condition are included in Vickers publication 9132 or 561, "Vickers Guide to Systemic Contamination Control". The book also includes information on the Vickers concept of "ProActive Maintenance". The following recommendations are based on ISO cleanliness levels at 2 µm, 5 µm and 15 µm.

For products in this catalog the recommended levels are:  
0 to 70 bar (1000 psi) ..... 18/16/13  
70 + bar (1000 + psi) ..... 17/15/12

Vickers products, as any components, will operate with apparent satisfaction in fluids with higher cleanliness codes than those described. Other manufacturers will often recommend levels above those specified.

Experience has shown, however, that life of any hydraulic components is shortened in fluids with higher cleanliness codes than those listed above. These codes have been proven to provide a long trouble-free service life for the products shown, regardless of the manufacturer.

## Hydraulic Fluids

Materials and seals used in these valves are compatible with antiwear hydraulic oils, and non-alkyl-based phosphate esters. The extreme operating viscosity range is 500 to 13 cSt (2270 to 70 SUS) but the recommended running range is 54 to 13 cSt (245 to 70 SUS).

## Installation

The proportional valves in this catalog can be mounted in any attitude, but it may be necessary in certain demanding applications, to ensure that the solenoids are kept full of hydraulic fluid. Good installation practice dictates that the tank port and any drain port are piped so as to keep the valves full of fluid once the system start-up has been completed.

## Mounting Bolt Kits

For K(B)SDG4V-3

BK02-156493M(metric)

BK590716 (inch)

*If not using Vickers recommended bolt kits, bolts used should be to ISO 898, 12.9 or better.*

## Seal Kits

KSDG4V-3-1\* ..... 565108

KBSDG4V-3-1\* ..... 02-332693

## Plugs

KBSDG4V

7-pin plug (metal) ..... 934939

7-pin plug (plastic) ..... 694534

(metal plug must be used for full EMC protection)

## Plugs

KSDG4V

Solenoid (grey) ..... 710776

LVDT (grey) ..... 458939

**NOTE:** An alternative metal connector which gives EMC protection but not IP67 rating is available from ITT-Cannon, part number CA02-COM-E-14S-A7-P.

## Extension Cable

**Extension Cable:** Adapter for extending 7 core cable when changing from KA to KB valve and existing wiring is not long enough. Consists of a 7 pin plug, a 7 pin socket and a length of cable, fully assembled for ease of use

Extension Cable ..... 944450

## Service Information

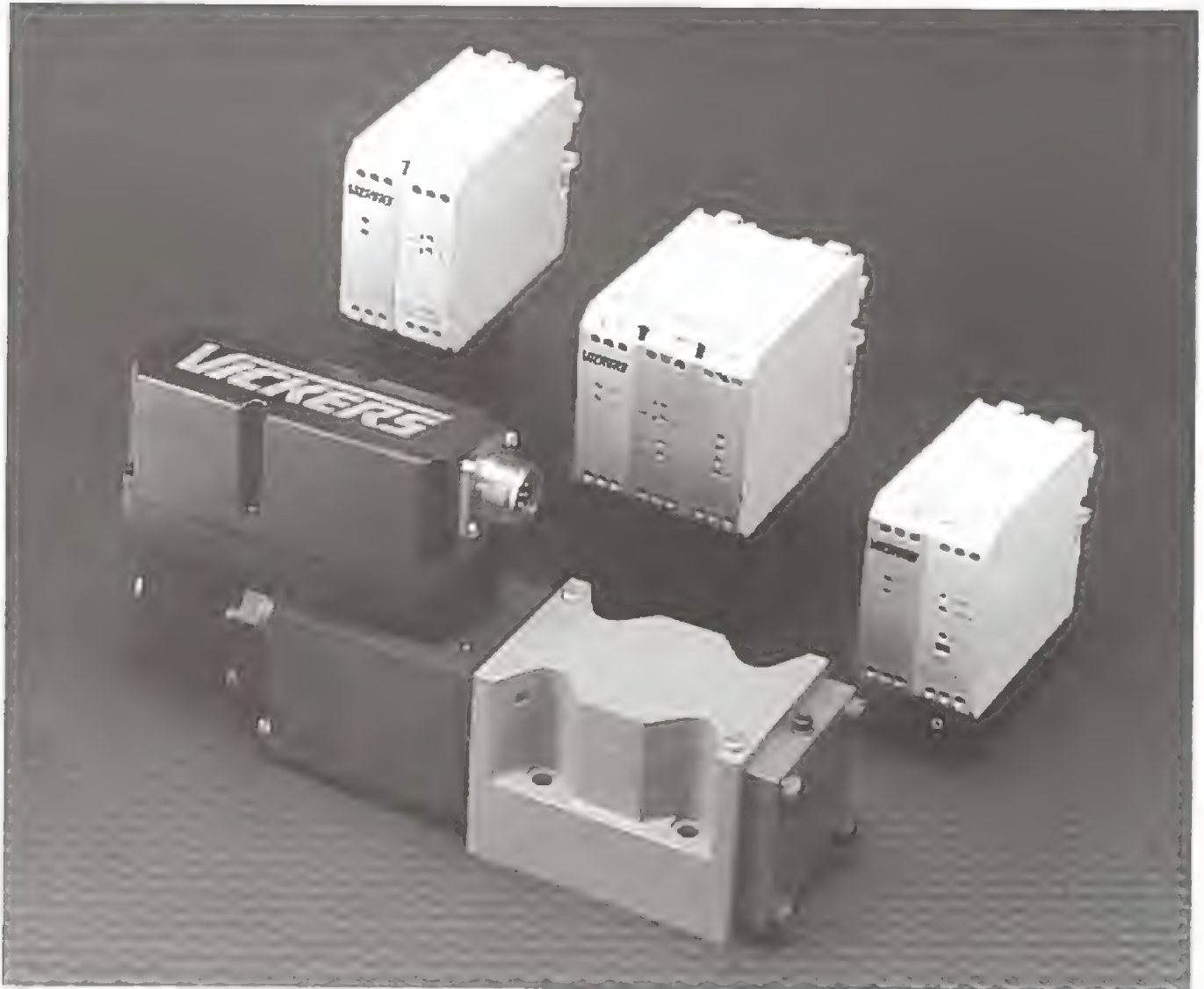
The products from this range are preset at the factory for optimum performance; disassembling critical items would destroy these settings. It is therefore recommended that should any mechanical or electronic repair be necessary they should be returned to the nearest Vickers repair center. The products will be refurbished as necessary and retested to specification before return.


Field repair is restricted to the replacement of the seals.

*Note: The feedback/solenoid assembly installed in this valve should not be disassembled.*

## Proportional Directional Valves with Feedback

KBSDG4V-5, 1\* Series – Pressures to 315 bar (4500 psi)



*This product has been designed and tested to meet specific standards outlined in the European Electromagnetic Compatibility Directive (EMC) 89/336/EEC, amended by 91/263/EEC, 92/31/EEC and 93/68/EEC, article 5. For instructions on installation requirements to achieve effective protection levels, see this leaflet and the Installation Wiring Practices for Vickers Electronic Products leaflet 2468. Wiring practices relevant to this Directive are indicated by  Electromagnetic Compatibility (EMC).*

5071.03/EN/1097/AA

# Introduction

## General Description

KBSDG4V-5 line offers a range of proportional directional valves with integral control electronics. Factory-set adjustments of gain and offset ensure consistent reproducibility valve-to-valve.

These four-way solenoid operated proportional valves have a high dynamic performance which enables them to be used in closed loop applications, previously possible only with servo valves. Various spool options are available for rated flows up to 80 L/min (21 USgpm). Working pressures are to 315 bar (4500 psi). The spool position is monitored by an LVDT which feeds back information to the amplifier, enabling spool position to be accurately maintained.

This valve is currently available with an integral amplifier built directly onto the valve.

The only electrical inputs required are power supply (24V) and a voltage command signal of  $\pm 10V$ . The amplifier is housed in a robust metal enclosure, sealed against ingress of water and other fluids. Electrical connections are via an industry standard 7-pin plug.

A spool position monitor pin allows the function of the valve to be electrically monitored. Ramp functions, if required, can be generated externally.

### Features and Benefits

- Wide range of zero lap spool and flow rate options.
- Supported by a broad range of auxiliary function modules.
- Electronic feedback LVDT ensures accurate spool position control.
- Internal current feedback provides optimal control.
- Vibration and shock tested.
- Full CE electromagnetic compatibility.

- Factory-sealed adjustments ensure valve-to-valve reproducibility
- Installation wiring reduced and simplified.
- Standard 7-pin connector.
- Standard 24V DC supply with wide tolerance band.
- Standard  $\pm 10 V$  DC command signals.
- Valve with integrated amplifier selected, ordered, delivered and installed as one performance-tested package.
- Spool position monitor pin to help with troubleshooting.
- Simple valve removal and replacement for service (plug & play).
- IP67 valve, environmental protection rating.
- Optional valve enable function.

## Contents

Introduction .....	B.102
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Pressures and flow rates .....	B.106
Performance curves .....	B.106
Installation dimensions .....	B.107
Subplates and mounting surfaces .....	B.108
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Application data .....	B.112

# Model Codes

**KBS D G 4 V-5-9 \* L -\*\* - \*\*\* - H -7 1\***  

[1]
[2]
[3]
[4]
[5]
[6]
[7]
[8]
[9]
[10]
[11]
[12]
[13]

## [1] Valve type

**KBS** – Servo performance proportional valve with integral amplifier and electronic feedback

## [2] Control type

**D** – Directional valve

## [3] Mounting

**G** – Subplate mounted

## [4] Operation

**4** – Solenoid operated

## [5] Pressure rating

**V** – 315 bar (4500 psi)

## [6] Interface

**5** – ISO 4401, size 05-04-0-94  
ANSI/B93.7M-Size 05

## [7] Spool type, center condition

**9** – Zero/underlap

## [8] Spool type, spring offset condition

**2** – P,A,B,T blocked  
**6** – P blocked, A & B to tank

## [9] Rated flow at 70 bar (1000 psi) loop $\Delta p$ pressure drop

**25** – 25 L/min (6.5 USgpm)  
**50** – 50 L/min (13.0 USgpm)  
**80** – 80 L/min (21.0 USgpm)

For actual maximum flow refer to Power capacity envelope curves, page B.107.

## [10] Electrical connection

**PC7** – 7 pin connector without plug  
**PE7** – 7 pin connector with plug  
**PH7** – As PE7 but with pin “C” used for enable signal  
**PR7** – As PC7 but with pin “C” used for enable signal

## [11] Electrical power

**H** – 24 VDC amplifier supply

## [12] Port T pressure limit code

**7** – for all spools

## [13] Design number

**1\*** series. Subject to change



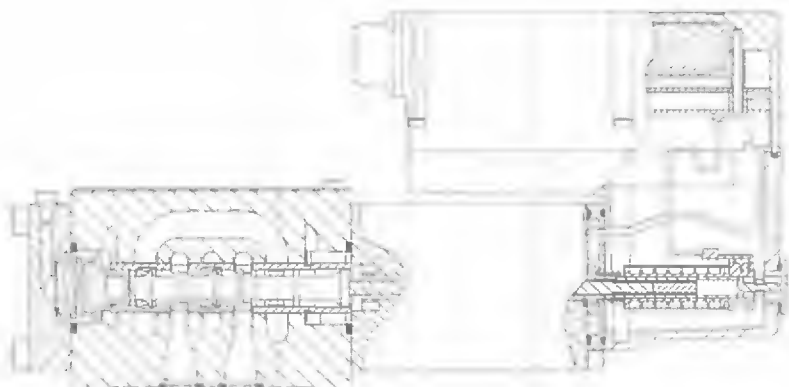
### Warning

Valves with integral amplifiers are supplied with or without the metal 7-pin plug. The Vickers plug, part no. 934939, must be correctly fitted to ensure that the EMC rating and IP67 rating are achieved. The plug retaining nut must be tightened with a torque of 2,0-2,5 Nm (1.5-2.0 lbf ft), and the cable clamp (cable outside diameter range, 8,0–10,5 mm [0.31–0.41 inches]) tightened as required to effect a proper seal.



# Spool Data

## Typical Section View



KBSDG4V-5

## Spool Symbols

Available Spools for KBSDG4V-5



Spool type 92L



Spool type 96L

## Spool Types and Flow Ratings

### Symmetric Spools

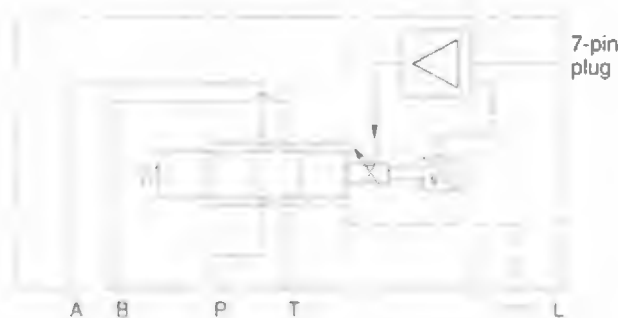
Base line pressure drop ( $\Delta p$ ) = 35 bar (500 psi) per metering flow path, e.g. B to T.  
For actual maximum flow refer to power capacity envelope curves.

Spool code	Spool symbol	Flow rating
For KBSDG4V-5 valves:		
92L25	92L	25 L/min (6.5 USgpm)
92L50	92L	50 L/min (13 USgpm)
92L80	92L	80 L/min (21 USgpm)
96L25	96L	25 L/min (6.5 USgpm)
96L50	96L	50 L/min (13 USgpm)
96L80	96L	80 L/min (21 USgpm)

## Functional Symbol

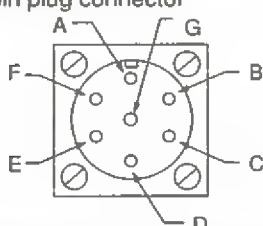
### Model Type KBSDG4V-5

proportional directional valve (with integral electronics)



# Operating data

Data is typical with fluid at 36 cST (168 SUS) and 50°C (122°F)

Power supply	24V DC (21V to 36V including 10% peak-to-peak max. ripple) max current 3,7A																		
Command signal	0 to +10V DC, or 0 to -10V DC, or -10 V to +10 V DC																		
Input impedance	47 kΩ																		
Common mode voltage to pin B	18V (max)																		
Valve enable signal for model code PH7 & PR7																			
Enable	>8.5V (36V max)																		
Disable	<6.5V																		
Input impedance	10 kΩ																		
7-pin plug connector	<table> <tr> <th>Pin</th><th>Description</th></tr> <tr> <td>A</td><td>Power supply positive (+)</td></tr> <tr> <td>B</td><td>Power 0V</td></tr> <tr> <td>C</td><td>Command/Monitor 0V (PE7 &amp; PC7)</td></tr> <tr> <td>C</td><td>Valve enable (PH7 &amp; PR7)</td></tr> <tr> <td>D</td><td>Command signal (+)-non-inverting input</td></tr> <tr> <td>E</td><td>Command signal (-)-inverting input</td></tr> <tr> <td>F</td><td>Monitor output</td></tr> <tr> <td>G</td><td>Protective ground</td></tr> </table>	Pin	Description	A	Power supply positive (+)	B	Power 0V	C	Command/Monitor 0V (PE7 & PC7)	C	Valve enable (PH7 & PR7)	D	Command signal (+)-non-inverting input	E	Command signal (-)-inverting input	F	Monitor output	G	Protective ground
Pin	Description																		
A	Power supply positive (+)																		
B	Power 0V																		
C	Command/Monitor 0V (PE7 & PC7)																		
C	Valve enable (PH7 & PR7)																		
D	Command signal (+)-non-inverting input																		
E	Command signal (-)-inverting input																		
F	Monitor output																		
G	Protective ground																		
 <p>View of pins of fixed half.</p>																			
Electromagnetic compatibility (EMC):																			
Emission (10 V/m)	EN 50081-2																		
Immunity (10 V/m)	EN 50082-2																		
Zero adjustment	± 18% mechanical adjustment accessible under plug in LVDT																		
Monitor point signal	± 10 V DC for full spool stroke																		
Output impedance	10kΩ																		
Power stage PWM frequency	10 kHz nominal																		
Reproducibility, valve-to-valve (at factory settings):																			
Flow gain at 100% command signal	≤ 5%																		
Protection:																			
Electrical	Reverse polarity protected																		
Mechanical	IEC 144, Class IP67																		
Ambient air temperature range for full performance	0° C to 70° C (32° F to 158° F)																		
Oil temperature range for full performance	0° C to 70° C (32° F to 158° F)																		
Minimum temperature at which valves will work at reduced performance	-20° C (-4° F)																		
Storage temperature range	-25° C to +85° C (-13° F to +185° F)																		
Supporting products:																			
Auxiliary electronic modules (DIN-rail mounting):																			
EHA-CON-201-A2* signal converter	See catalog GB 2410A																		
EHD-DSG-201-A-1* command signal generator	See catalog GB 2470																		
EHA-RMP-201-A-2* ramp generator	See catalog GB 2410A																		
EHA-PID-201-A-2* PID controller	See catalog GB 2427																		
EHA-PSU-201-A-10 power supply	See catalog GB 2410A																		
Relative duty factor	Continuous rating (ED = 100%)																		
Hysteresis	< 0.5%																		

## Operating data (continued)

### Step response:

Step size (% of max spool stroke):

0 to 100% or 100 to 0%

10 to 90% or 90 to 10%

25 to 75% or 75 to 25%

+90 to -90%

Time to reach 90% of required step:

24 ms

21 ms

20 ms

33 ms

Mass: KBSDG4V-5

5,9 kg (13 lb) approx..

## Pressures and Flow Rates Maximum pressures, bar (psi)

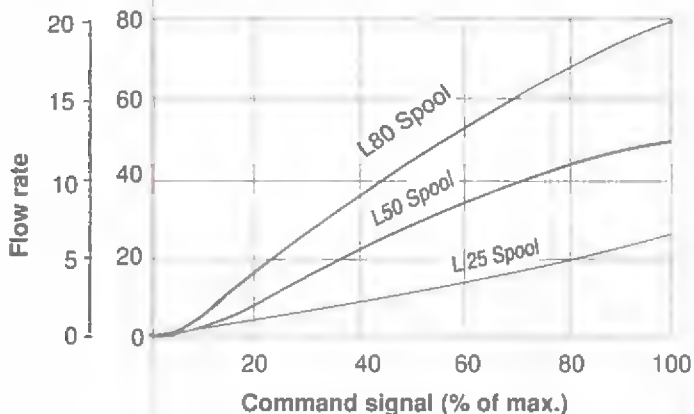
Port L condition	Ports P, A, B	T	L
Normally blocked by mounting surface	315 (4500)	160 (2300)	160 (2300)
Drained directly to tank	315 (4500)	210 (3000)	10 (145)

## Performance Curves

### Flow Gain

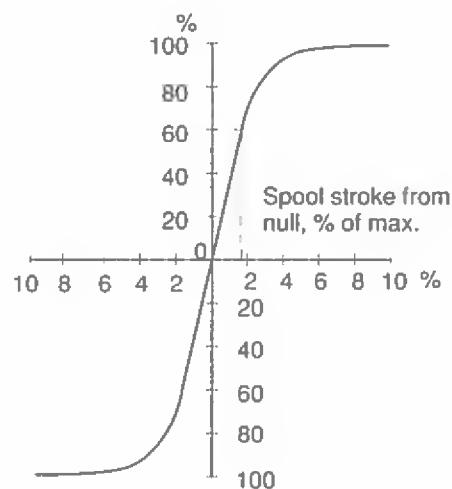
Flow from port P-A-B-T or P-B-A-T at 70 bar (1000 psi)  
total valve  $\Delta p$  (35 bar (500 psi) per metering edge)

USgpm L/min

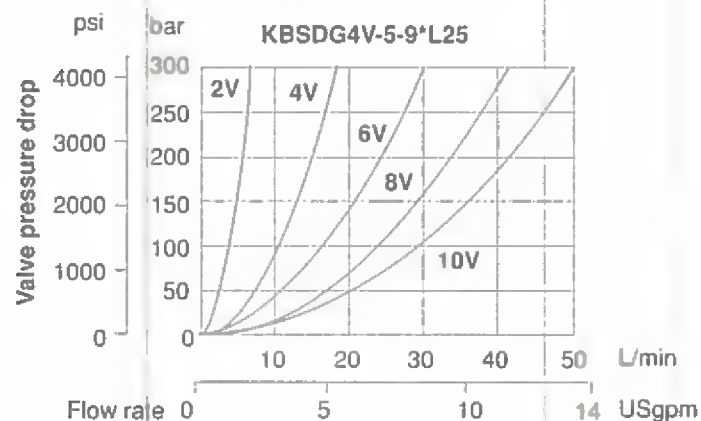


### Pressure Gain

$\Delta p$  between ports A and B or B and A, as % of port P pressure



### Power Capacity Envelope



At other pressure drop ( $\Delta p$ ) values,  
flow rates  $Q_x$  approximate to:

$$Q_x = Q_D \sqrt{\frac{\Delta p_x}{\Delta p_D}}$$

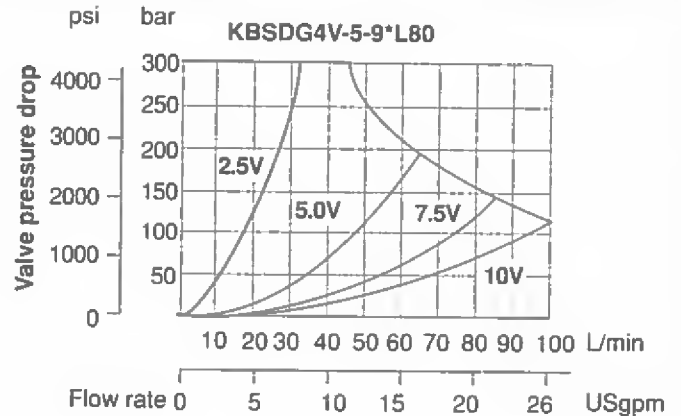
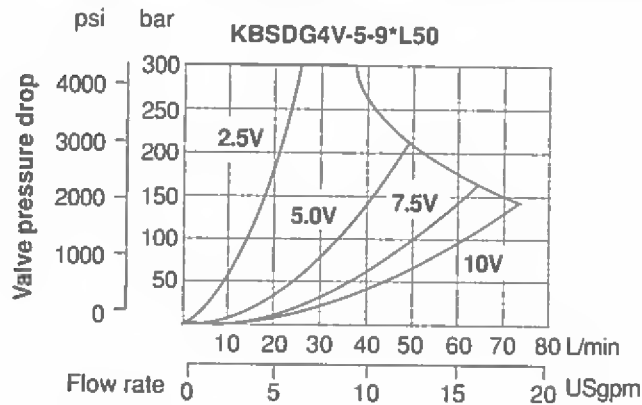
where  $Q_D$  = Datum flow rate

$\Delta p_D$  = Pressure drop at datum flow rate

$\Delta p_x$  = Required  $\Delta p$

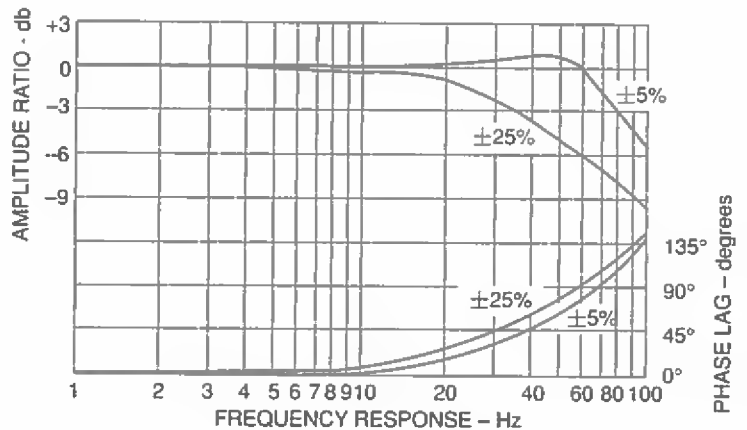
Limited by valve capacity. Refer to Power Capacity envelope.

## Power Capacity Envelopes



## Frequency Response

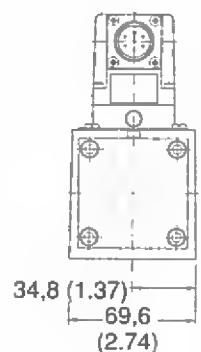
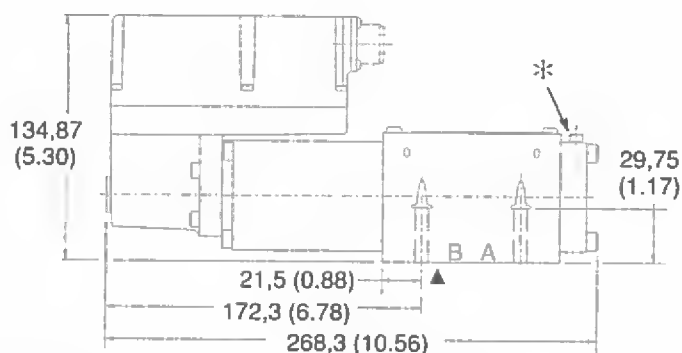
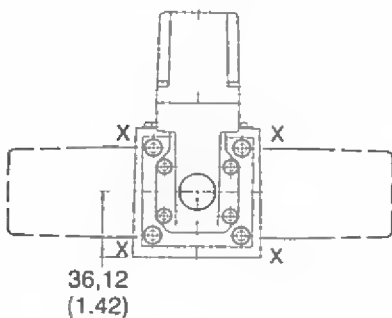
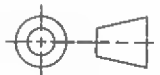
Typical amplitudes of  $\pm 5\%$  and  $\pm 25\%$  with zero offset.  $\Delta p$  (P to T)=70 bar



## Installation Dimensions

mm (inch)

3rd angle projection



Amplifier and solenoid assembly may be rotated 90° as shown by removing 4 screws shown X. Re-torque to 13-15 Nm (10-11 lbf ft)

※Note: Bleed screw locations Air bleed, Socket Head Cap Screw. Torque to 2,5-3,0 Nm (2.0-2.5 lbf ft)

▲ Mounting surface seals supplied. For mounting surface dimensions and subplate options see next page.



### Warning

Valves with integral amplifiers are supplied with or without the metal 7-pin plug. The Vickers plug, part no. 934939, must be correctly fitted to ensure that the EMC rating and IP67 rating are achieved. The plug retaining nut must be tightened with a torque of 2,0-2,5 Nm (1.5-2.0 lbf ft) to effect a proper seal.

# Subplates and Mounting Surfaces

## General Description

When a subplate is not used, a machined pad must be provided for valve mounting. Pad must be flat within 0,0127 mm (.0005 inch) and smooth within 1,6  $\mu$ m (63 microinch). Mounting bolts, when provided by customer, should be ISO 898 class 12.9 or better.

## Dimensional Tolerances

Dimensional tolerance on interface drawings is  $\pm 0,2$  mm ( $\pm 0.008$ " ) except where otherwise stated. ISO 4401 specifies inch conversion to  $\pm 0,01$ ".

## Conversion from Metric

ISO 4401 gives dimensions in mm. Inch conversions are accurate to 0.01" unless otherwise stated.

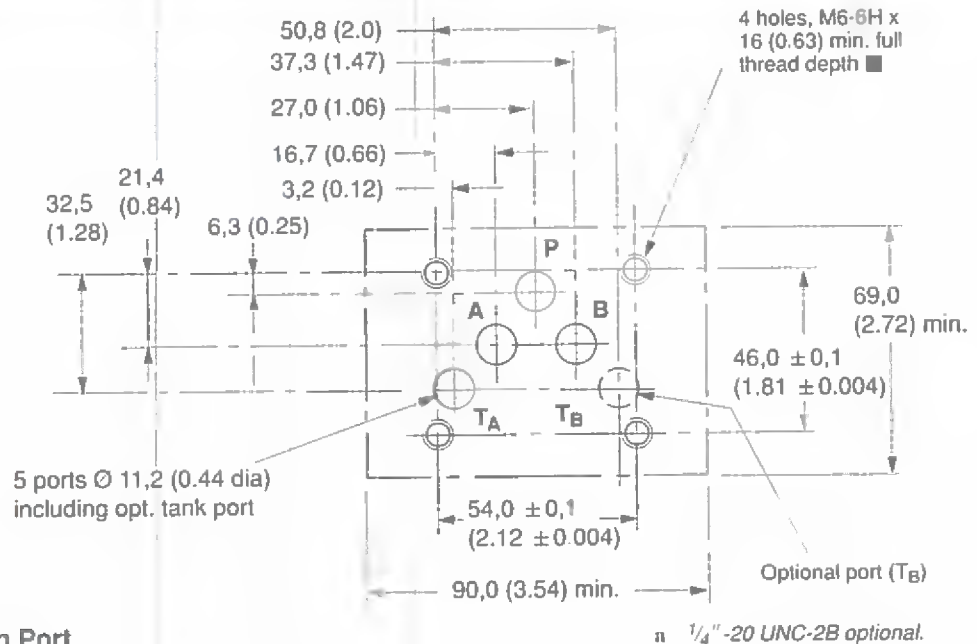
## Mounting Bolt Tappings

ISO 4401 gives metric thread tappings. Alternate UNC tappings are Vickers recommendations that allow these plates and associated valves to be used up to their maximum pressures, when using Vickers recommended bolt kits, or bolts of an equivalent strength. It is recommended that Customer's own manifold blocks for UNC bolts should be tapped to the minimum depths given in the footnotes.

## Mounting Surface Interface to ISO 4401

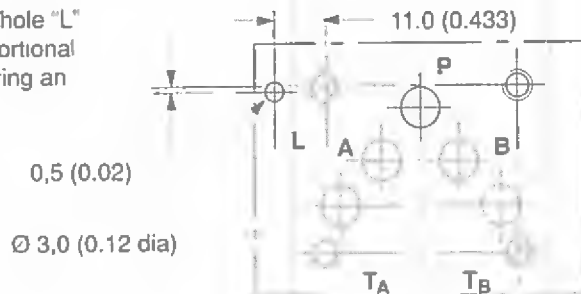
### Size 05

This interface conforms to:  
ISO 4401-05:04-0-94  
ANSI/B93.7M (and NFPA) size 05  
CETOP R35M4.2-05  
DIN 24340 Form A10



### Interface with Additional Drain Port

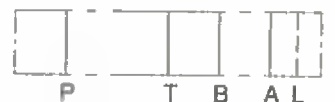
The interface conforms to Vickers standard, plus hole "L". Typically used for proportional and other valves requiring an additional drain port.



## Sub-plate Installation Dimensions

Subplates with Rear Ports P, T, A, B, Maximum Pressure 210 bar (3000 psi)

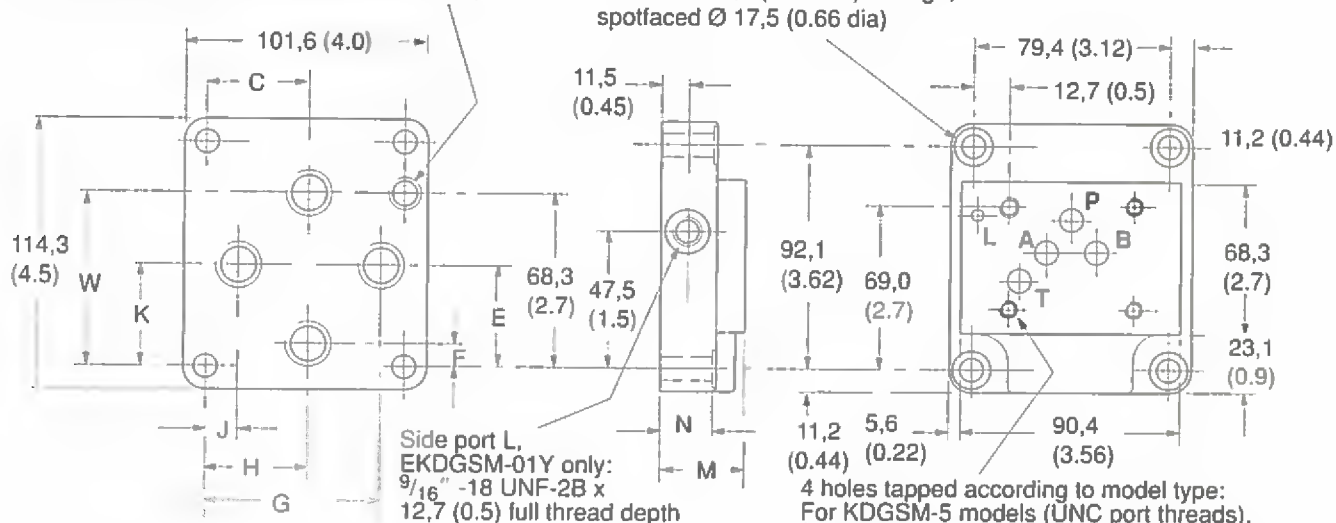
Model types: KD GSM-5-676805-2\*  
(with rear port L)  
EKD GSM-01Y-1\*-R  
(with side port L)



Rear port L, KD GSM-5-676805 only:

G  $\frac{1}{8}$  ( $\frac{1}{8}$ " BSPF) x 12,0 (0.47) full thread depth

4 holes  $\varnothing$  10,8 (0.42 dia) through,  
spotfaced  $\varnothing$  17,5 (0.66 dia)



Mass = 1,3 kg (2.9 lbs)

4 holes tapped according to model type:  
For KD GSM-5 models (UNC port threads),  
 $\frac{1}{4}$ " -20 UNC-2B x 12,7 (0.5) deep.  
For EKD GSM-01Y models (BSPF port threads),  
M6 x 15,8 (0.62) deep.

### Model

### Ports P, T, A, B Threads

210 bar (3000 psi) KD GSM-5-676805-2	3/4" -16 UNF-2B x 14,0 (0.56) full thread depth
280 bar (4000 psi) EKD GSM-01Y-10-R	G 1/2 (1/2" BSPF) x 15,0 90.59 full thread depth

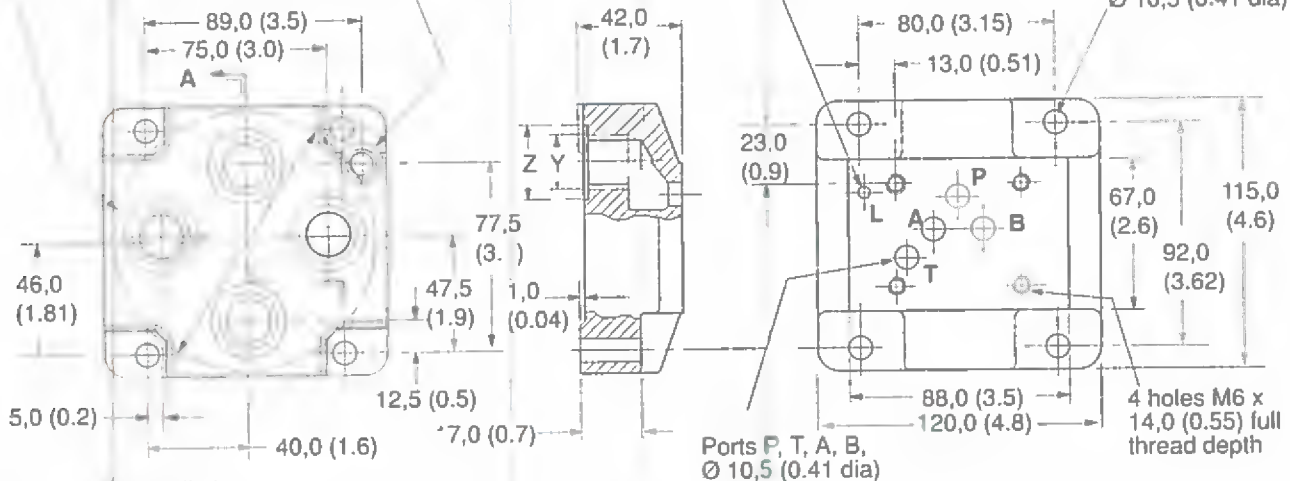
### Dimensions

Model	C	E	F	G	H	J	K	M	N	W
210 bar (3000 psi) KD GSM-5-676805-2	45,2 (1.78)	42,1 (1.66)	19,0 (0.75)	68,3 (2.69)	45,2 (1.78)	23,8 (0.94)	42,1 (1.66)	31,8 (1.25)	23,8 (0.94)	57,1 (2.25)
280 bar (4000 psi) EKD GSM-01Y-10-R	39,7 (1.56)	40,5 (1.59)	9,9 (0.39)	70,6 (2.78)	39,7 (1.56)	10,7 (0.42)	40,5 (1.59)	36,5 (1.44)	28,6 (1.13)	72,6 (2.86)



All dimensions in mm (inches)

4 holes  
Ø 10,5 (0.41 dia)

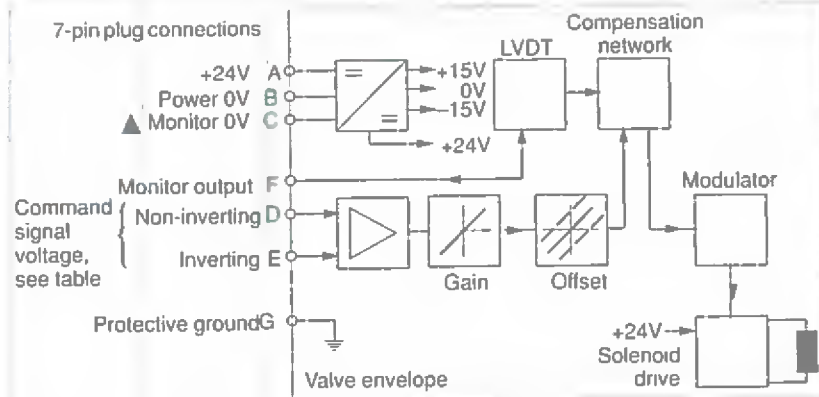


Mass = 1,3 Kg (2.9 lbs)

Model	Y Thread	Z diameter
KDGSM-5-6 5225-10	G1/2 (1/2" BSPF) x 14,0 (0.55) full thread depth	30,0 (1.18)
KDGSM-5-6 5226-10	G3/4 (3/4" BSPF) X 16,0 (0.63) full thread depth	33,0 (1.30)

7-pin plug		Flow direction
Pin D	Pin E	
Positive	OV	P to A
OV	Negative	
$U_D \cdot U_E = \text{Positive}$		P to B
Negative	OV	
OV	Positive	
$U_D \cdot U_E = \text{Negative}$		

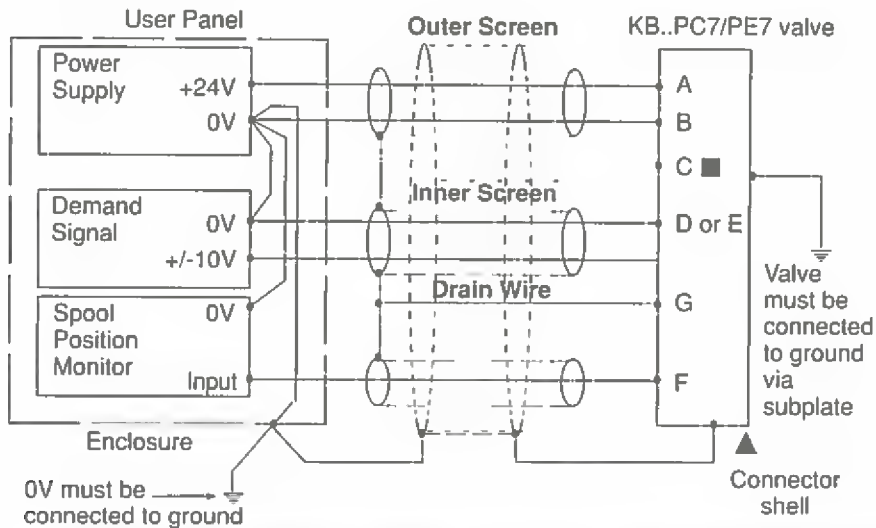
For 24V supply  
0,75 mm<sup>2</sup> (18 AWG) up to 20m (65 ft)  
1.00 mm<sup>2</sup> (16 AWG) up to 40m (130 ft)



**Warning**  
All power must be switched off before connecting or disconnecting any plugs.

# Typical Connection Arrangements

## Wiring Connections



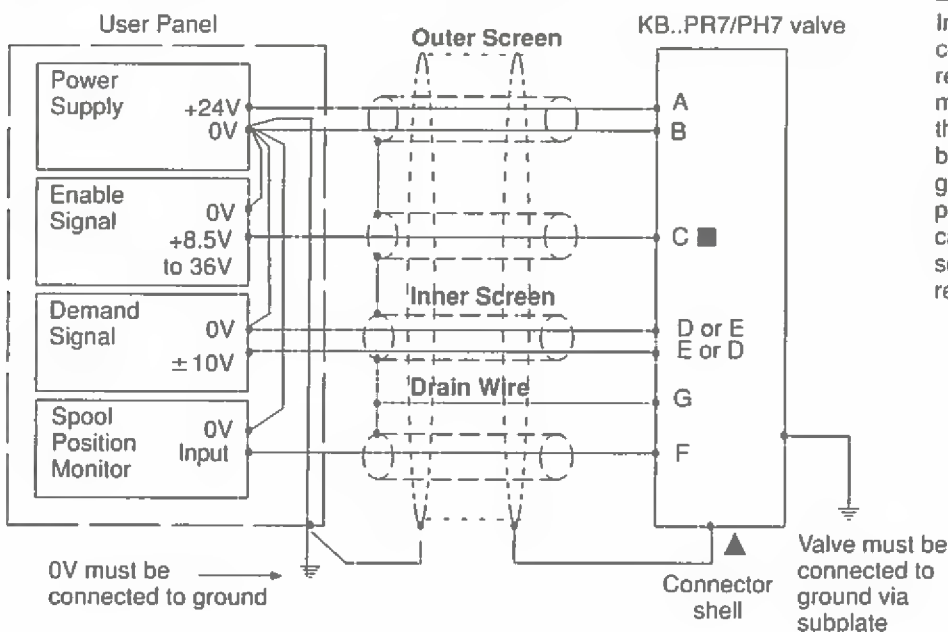
■ Spool position monitor voltage (pin F) will be referenced to the KB valve local ground. A "local ground" (pin C) is provided on PC7/PE7 versions for optional use by differential input customer supplied electronics.



### WARNING

Do not ground pin C. If the local ground (pin C) is not used for differential monitor electronics, do not use. Read monitor pin F with respect to ground.

## Wiring Connections for Valves with Enable Feature



### ▲ Note:

In applications where the valve must conform to European RFI/EMC regulations, the outer screen (shield) must be connected to the outer shell of the 7 pin connector, and the valve body must be fastened to the earth ground. Proper earth grounding practices must be observed in this case, as any differences in command source and valve ground potentials will result in a screen (shield) ground loop.



### Warning

#### Electromagnetic Compatibility (EMC)

It is necessary to ensure that the valve is wired up as above. For effective protection the user electrical cabinet, the valve subplate or manifold and the cable screens should be connected to efficient ground points. The metal 7 pin connector part no. 934939 should be used for the integral amplifier.

In all cases both valve and cable should be kept as far away as possible from any sources of electromagnetic radiation such as cables carrying heavy current, relays and certain kinds of portable radio transmitters, etc. Difficult environments could mean that extra screening may be necessary to avoid the interference.

It is important to connect the 0V lines as shown above. The multi-core cable should have at least two screens to separate the demand signal and monitor output from the power lines.

The enable line to pin C should be outside the screen which contains the demand signal cables.

# Application Data

## Fluid Cleanliness

Proper fluid condition is essential for long and satisfactory life of hydraulic components and systems. Hydraulic fluid must have the correct balance of cleanliness, materials and additives for protection against wear of components, elevated viscosity and inclusion of air.

Recommendations on contamination control methods and the selection of products to control fluid condition are included in Vickers publication 9132 or 561, "Vickers Guide to Systemic Contamination Control". The book also includes information on the Vickers concept of "ProActive Maintenance". The following recommendations are based on ISO cleanliness levels at 2 µm, 5 µm and 15 µm.

For products in this catalog the recommended levels are:  
0 to 70 bar (1000 psi) ..... 18/16/13  
70 + bar (1000 + psi) ..... 17/15/12

Vickers products, as any components, will operate with apparent satisfaction in fluids with higher cleanliness codes than those described. Other manufacturers will often recommend levels above those specified.

Experience has shown, however, that life of any hydraulic components is shortened in fluids with higher cleanliness codes than those listed above. These codes have been proven to provide a long trouble-free service life for the products shown, regardless of the manufacturer.

## Hydraulic Fluids

Materials and seals used in these valves are compatible with **antiwear** hydraulic oils, and non-alkyl-based phosphate esters. The extreme operating viscosity range is 500 to 13 cSt (2270 to 70 SUS) but the recommended running range is 54 to 13 cSt (245 to 70 SUS).

## Installation

The proportional valves in this catalog can be mounted in any attitude, but it may be necessary in certain demanding applications, to ensure that the solenoids are kept full of hydraulic fluid. Good installation practice dictates that the tank port and any drain port are piped so as to keep the valves full of fluid once the system start-up has been completed.

## Mounting Bolt Kits

For KBSDG4V-5

BKDG01633M (metric)

BKDPNG40706 (inch)

*If not using Vickers recommended bolt kits, bolts used should be to ISO 898, 12.9 or better.*

## Seal Kits

KBSDG4V-5 ..... 02-332751

## Plugs

KBSDG4V

7-pin plug (metal) ..... 934939

7-pin plug (plastic) ..... 694534

(metal plug must be used for full EMC protection)

## Extension Cable

**Extension Cable:** Adapter for extending 7 core cable when changing from KA to KB valve and existing wiring is not long enough. Consists of a 7 pin plug, a 7 pin socket and a length of cable, fully assembled for ease of use

Extension Cable ..... 944450

## Service Information

The products from this range are preset at the factory for optimum performance; disassembling critical items would destroy these settings. It is therefore recommended that should any mechanical or electronic repair be necessary they should be returned to the nearest Vickers repair center. The products will be refurbished as necessary and retested to specification before return.

Field repair is restricted to the replacement of the seals.

*Note: The feedback/solenoid assembly installed in this valve should not be disassembled.*

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# Model Code

**K B H D G 5 V - \* - \*\*\*\* - (E) X - T - \*\*\* - H 4 - \*\***  
 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

## 1 Valve type

**K** – Proportional valve

## 2 Integral amplifier

**B** – Integral amplifier “B” series

## 3 Feed back arrangement

**H** – From pilot and main stages

## 4 Control type

**D** – Directional valve

## 5 Mounting

**G** – Subplate mounted

## 6 Operation

**5** – Solenoid controlled, pilot operated

## 7 Pressure rating

**V** – 310 bar (4500 psi) Size 05  
– 350 bar (5000 psi) Size 07

## 8 Interface

ISO 4401

**5** – Size 05

**7** – Size 07



### Warning

Valves with integral amplifiers are supplied with or without the metal 7-pin plug. The Vickers plug, part no. 934939, must be correctly fitted to ensure that the EMC rating and IP67 rating are achieved. The plug retaining nut must be tightened with a torque of 2-2,5 Nm (1.5-2.0 lbf ft) to effect a proper seal.

## 9 Spool type, flow rating and metering

See “Functional Symbol” on page B.117.  $\Delta p = 5$  bar (72 psi) per metering flow path, e.g. B to T.

### Symmetric spools

For KBHDG5V-5 valves:

**2C100N** – 100 L/min (26 US gpm)

**33C80N** – 80 L/min (21 US gpm)

**5C85N** – 85 L/min (22 US gpm)

For KBHDG5V-7 valves:

**2C200N** – 200 L/min (52 US gpm)

**33C160N** – 160 L/min (42 US gpm)

**5C200N** – 200 L/min (52 US gpm)

### Asymmetric spools

First figure (\*\*N) is flow rating P-A, or A-T (“A” port flow); last figure (N\*\*) is flow rating P-B, or B-T (“B” port flow)

For KBHDG5V-5 valves:

**2C70N45** – 70 L/min (18.5 US gpm), “A” port flow  
45 L/min (11.9 US gpm), “B” port flow

**33C65N40** – 65 L/min (17.2 US gpm), “A” port flow  
40 L/min (10.6 US gpm), “B” port flow

For KBHDG5V-7 valves:

**2C150N85** – 150 L/min (40 US gpm), “A” port flow  
85 L/min (22.4 US gpm), “B” port flow

**33C130N65** – 130 L/min (33.3 US gpm), “A” port flow  
65 L/min (17.2 US gpm), “B” port flow

For actual maximum flows refer to power capacity envelopes, page B.121.

## 10 Pilot supply ▲

**Blank** – Internal-no reducer

**E** – External (no reducer)

**X** – Internal (through integral reducer)

**EX** – External (through integral reducer)

▲ See section on maximum pressures (pages B.119 & B.120) for when pilot reducer must be used.

## 11 Pilot drain

**T** – Internal

Omit for external drain

## 12 Electrical connection

**PC7** – 7 pin connector without plug

**PE7** – 7 pin connector with plug

**PH7** – As PE7 but with pin “C” used for enable signal

**PR7** – As PC7 but with pin “C” used for enable signal

## 13 Coil rating

**H** – 24 VDC amplifier supply

## 14 Port T pressure limit rating

**4** – 50 bar (725 psi) (for internal pilot drain option only, item 11 above)

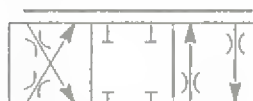
## 15 Design number

**10** – 10 series

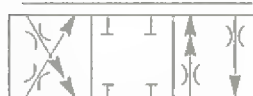
# Spool Data

## Spool Symbols

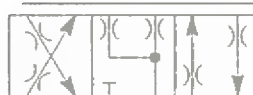
### Available Spools for KBHGD5V



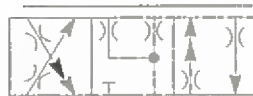
Spool type 2C\*\*N



Spool type 2C\*\*N\*\*



Spool type 33C\*\*N



Spool type 33C\*\*N\*\*



Spool type 5C\*\*N  
(zero lapped)

### Spool Types and Flow Ratings

#### Symmetric Spools

Base line pressure drop  $\Delta p = 5$  bar (75 psi) per metering flow path, e.g. B to T. For actual maximum flow refer to power capacity envelope curves.

Spool code	Spool symbol	Flow rating
For KBHGD5V-5 valves:		
2C100N	2C	100 L/min (26 USgpm)
33C80N	33C	80 L/min (21 USgpm)
5C85N	5C	85 L/min (22 USgpm)
For KBHGD5V-7 valves:		
2C200N	2C	200 L/min (52 USgpm)
33C160N	33C	160 L/min (42 USgpm)
5C200N	5C	200 L/min (52 USgpm)

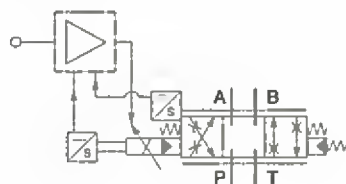
#### Asymmetric Spools

Figure preceding metering type designator, "N" e.g. 2C\*\*N) is flow rating P-A, or A-T ("A" port flow): Figure after "N" (N\*\*) is flow rating P-B, or B-T ("B" port flow).

Spool code	Spool symbol	Flow rating
For KBHGD5V-5 valves:		
2C70N45	2C	70 L/min (18.5 USgpm) "A" port flow 45 L/min (11.9 USgpm) "B" port flow
33C65N40	33C	65 L/min (17.2 USgpm) "A" port flow 40 L/min (10.6 USgpm) "B" port flow
For KBHGD5V-7 valves:		
2C150N85	2C	150 L/min (40 USgpm) "A" port flow 85 L/min (22.4 USgpm) "B" port flow
33C130N65	33C	130 L/min (33.3 USgpm) "A" port flow 65 L/min (17.2 USgpm) "B" port flow

**Note:** Valves with 5C spools are factory set so that with no command signal the pressure in port B is at least twice that in port A (blocked ports).

## Functional Symbol



### Spool Types



Type 2

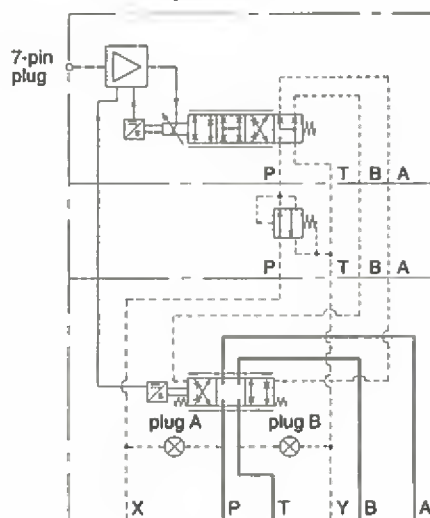


Type 33



Type 5

### Detailed symbol



### Application Notes

#### A. Main-Spool Options

Spools shown are meter-in/meter-out types. Center-condition options are types 2, 33 and 5.

#### B. Internally Piloted Models

Differ from detailed symbols above by omission of plug A and the blocking of port X by the mating surface.

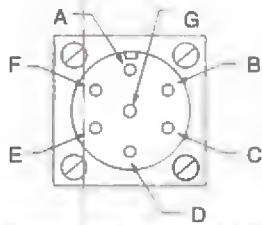
#### C. Internally Pilot Drain Models

Differ from detailed symbols above by omission of plug B and blocking of port Y by the mating surface.



# Operating Data

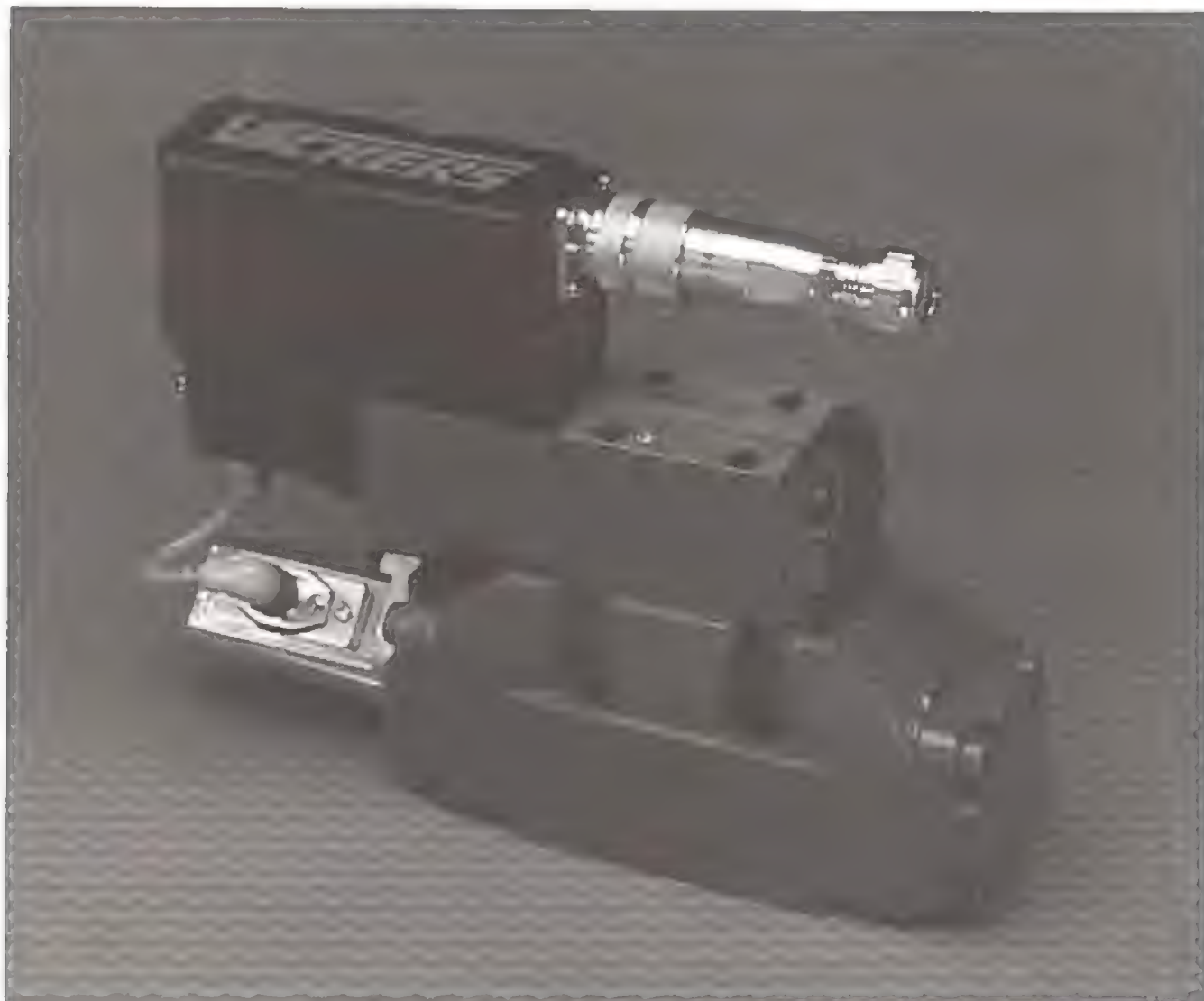
Data is typical with fluid at 36 cSt (168 SUS) and 50°C (122°F).


Power supply	24V DC (21V to 36V including 10% peak-to-peak max. ripple) max current 3A																		
Command signal Input impedance Common mode voltage to pin B	0 to +10V DC, or 0 to -10V DC, or -10 V to +10 V DC 47 kΩ 18V (max)																		
Valve enable signal for model codes PH7 & PR7 Enable Disable Input impedance	>8.5V (36V max) <6.5V 10 kΩ																		
7-pin plug connector   <p>View of pins of fixed half</p>	<table> <tr> <th>Pin</th><th>Description</th></tr> <tr> <td>A</td><td>Power supply positive</td></tr> <tr> <td>B</td><td>Power 0V</td></tr> <tr> <td>C</td><td>Command/Monitor 0V (PE7 &amp; PC7)</td></tr> <tr> <td>D</td><td>Valve enable (PH7 &amp; PR7)</td></tr> <tr> <td>E</td><td>Command signal (+)-non-inverting input</td></tr> <tr> <td>F</td><td>Command signal (-)-inverting input</td></tr> <tr> <td>G</td><td>Monitor output</td></tr> <tr> <td></td><td>Protective ground</td></tr> </table>	Pin	Description	A	Power supply positive	B	Power 0V	C	Command/Monitor 0V (PE7 & PC7)	D	Valve enable (PH7 & PR7)	E	Command signal (+)-non-inverting input	F	Command signal (-)-inverting input	G	Monitor output		Protective ground
Pin	Description																		
A	Power supply positive																		
B	Power 0V																		
C	Command/Monitor 0V (PE7 & PC7)																		
D	Valve enable (PH7 & PR7)																		
E	Command signal (+)-non-inverting input																		
F	Command signal (-)-inverting input																		
G	Monitor output																		
	Protective ground																		
Electromagnetic compatibility (EMC): Emission (10 V/m) Immunity (10 V/m)	EN 50081-2 EN 50082-2																		
Threshold command voltage (minimum voltage for minimum flow)	0V - 5C Spools 0.25V- 2C & 33C Spools																		
Monitor signal (pin F) Output impedance	± 10V DC for full spool stroke 10kΩ																		
Power stage PWM frequency	10 kHz nominal																		
Step input response, with flow through P-A-B-T, Δp=5 bar (72 psi) per metering path, e.g. P-A Required flow step:	Time to reach 90% of required step:																		
KBHDG5V-5      0 to 100% 100% to 0 +90 to -90%	24 ms 23 ms 35 ms																		
KBHDG5V-7      0 to 100% 100% to 0 +90 to -90%	24 ms 23 ms 36 ms																		
Reproducibility, valve-to-valve (at factory settings): Flow at 100% command signal	≤ 5%																		
Hysteresis with flow through P-A-B-T Δp=5 bar (72 psi) per metering path (P-A or B-T)	< 1%																		
Protection: Electrical Environmental	Reverse polarity protected IEC 144, Class IP67																		
Ambient air temperature range for full performance Oil temperature range for full performance	0° C to 70° C (32° F to 158° F) 0° C to 70° C (32° F to 158° F)																		
Minimum temperature at which valves will work at reduced performance	-20° C (-4° F)																		
Storage temperature range	-25° C to +85° C (-13° F to +185° F)																		

# Proportional Two-Stage Directional Valves

KBHDG5V-5/7, 10 Series

Pressures to 350 bar (5000 psi)



*This product has been designed and tested to meet specific standards outlined in the European Electromagnetic Compatibility Directive (EMC) 89/336/EEC, amended by 91/263/EEC, 92/31/EEC and 93/68/EEC, article 5. For instructions on installation requirements to achieve effective protection levels, see this leaflet and the Installation Wiring Practices for Vickers Electronic Products leaflet 2468. Wiring practices relevant to this Directive are indicated by  Electromagnetic Compatibility (EMC).*

5071.04/EN/1197/A

# Introduction

## General Description

Vickers proportional valves shown in this catalog are suitable for working pressures up to 350 bar (5000 psi) and flow rates to 200 l/min (53 USgpm).

They are designed to provide a controlled oil flow in proportion to a command signal, with spool position feedback to provide accurate control. Zero lapped spools are available for closed loop control applications and hydrostats are available for load compensation with size 7 valves.

### KBHDG5V-5/7

A range of proportional directional valves with control amplifiers built directly on, and prewired to, the valves. Factory-set adjustments of gain, spool deadband compensation, and offset ensure high valve-to-valve reproducibility.

The only electrical inputs required are power supply (24V) and a voltage command signal of  $\pm 10V$ . The amplifier is housed in a robust metal enclosure, sealed against ingress of water and other fluids. Electrical connections are via a standard 7-pin plug.

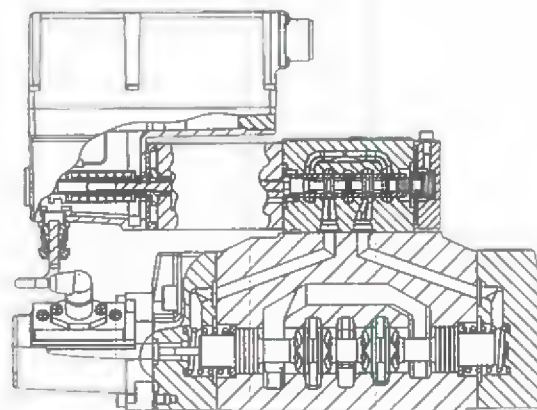
A spool position monitor point allows the function of the valve to be electrically monitored. Ramp functions, if required, can be generated externally.

### Features and Benefits

- Factory-sealed adjustments increase valve-to-valve reproducibility.
- Valve with integrated amplifier selected, ordered, delivered and installed as one performance-tested package.
- Electronic feedback LVDT ensures accurate spool position control.

- Vibration and shock tested.
- Standard 24V DC supply with wide tolerance band.
- Wide range of spool and flow rate options.
- Standard  $\pm 10 V$  DC command signals.
- Installation wiring reduced and simplified.
- Standard 7-pin connector.
- Simple valve removal and replacement for service.
- Supported by auxiliary function modules.
- Full CE electromagnetic compatibility.
- IP67 environmental protection rating.
- Optional valve enable function.
- Optional pilot pressure reducer.

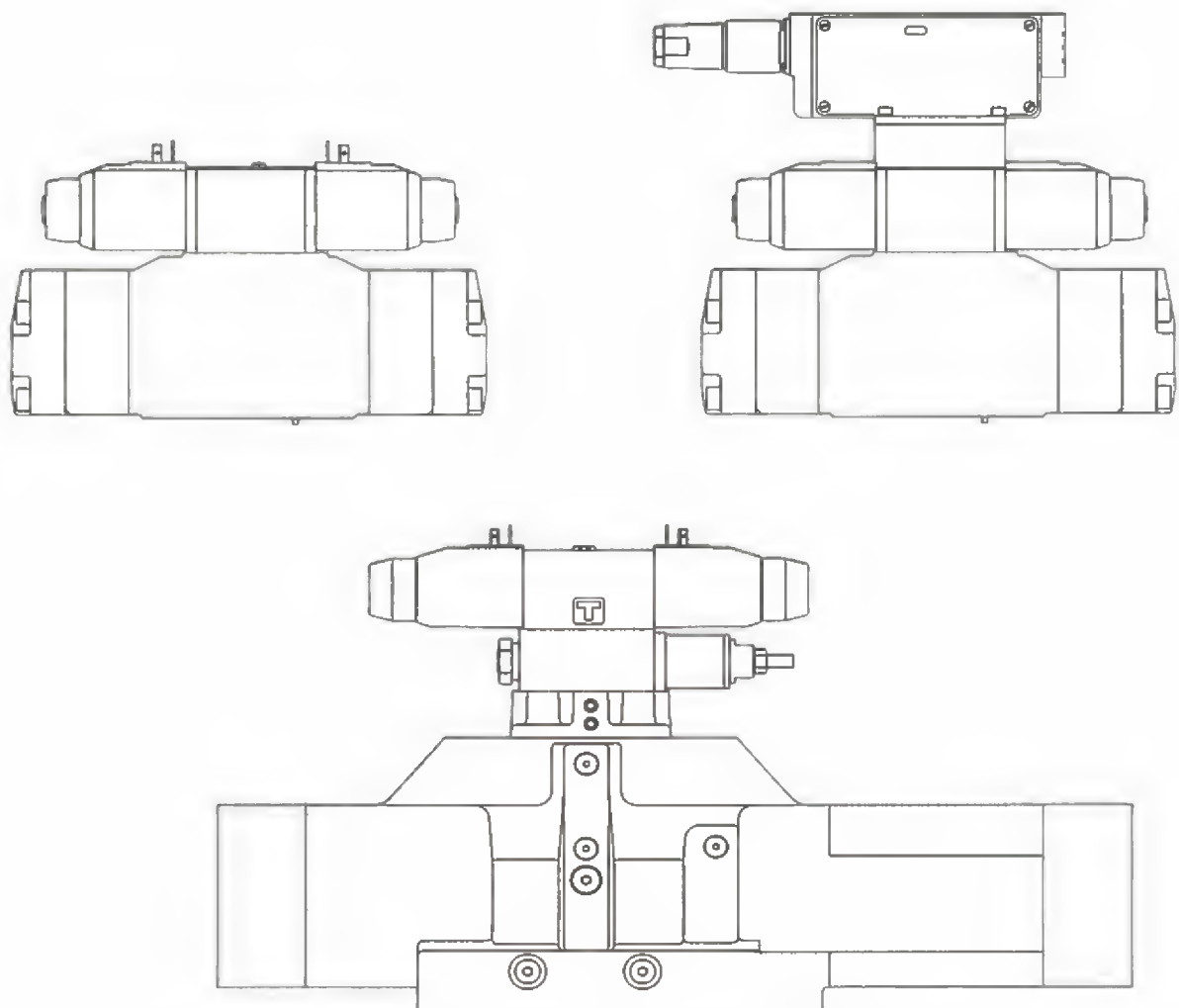
## Typical Section View




KBHDG5V-7, 10 Design

## Proportional Directional Control Valves

**K(A)DG5V-5/7/8 & KDG5V-10, 1\* Series,  
Two-Stage Models without Electrical Feedback  
ISO 4401 Sizes 05, 07, 08 and 10 ANSI/B93.7M-D07/08/09**



*This product has been designed and tested to meet specific standards outlined in the European Electromagnetic Compatibility Directive (EMC) 89/336/EEC, amended by 91/263/EEC, 92/31/EEC and 93/68/EEC, article 5. For instructions on installation requirements to achieve effective protection levels, see this leaflet, the Installation Wiring Practices for Vickers Electronic Products leaflet 2468 and leaflet 02-123931A which is packed with every KA valve. Wiring practices relevant to this Directive are indicated by  Electromagnetic Compatibility (EMC).*

5052/EN/1097/A

# Introduction

Vickers KDG5V-5/7/8/10 are solenoid operated directional control non-feedback type proportional valves.

Two-stage proportional directional control valves in which the main-stage spool is positioned according to the output from an integrally mounted proportional, solenoid-operated, pressure-reducing valve. Direction of main-spool travel depends upon which of the two solenoids of the pilot valve is energized and the amount of travel is dependent upon the current input to the solenoid.

At any intermediate position of the main spool, a force balance exists between the controlled, reduced pilot pressure acting on the spool end and the opposing centering spring, plus the action of flow forces. There is no electrical feedback of the main-stage spool position.

This range of valves offers effective and economic solutions for applications having repetitive load conditions throughout each operating cycle, e.g. mold closure/opening in plastics molding machinery.

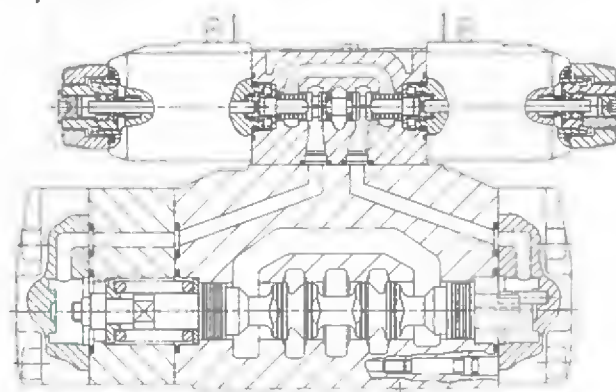
Valve sizes 5, 7 & 8 are available with integral amplifiers.

## Features and Benefits

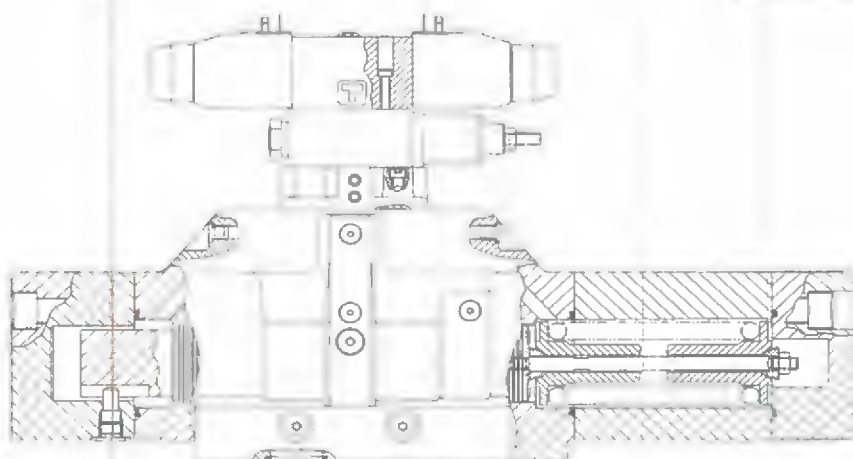
- These global products, manufactured to world-class quality standards, are sold and serviced throughout the world.
- These valves open up expanded application opportunities as a cost effective alternative to feedback-type proportional and servo valves.
- Vickers flexible design approach provides a wide variety of matching electronic amplifiers, valve options, and spool ratings.

## Typical Section Views

KDG5V-7 shown without "EX" or "X"  
(Without integral pilot pressure reducer)



KDG5V-10 shown with "EX" or "X"  
(With integral pilot pressure reducer)

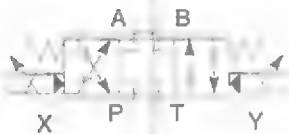


# Table of Contents

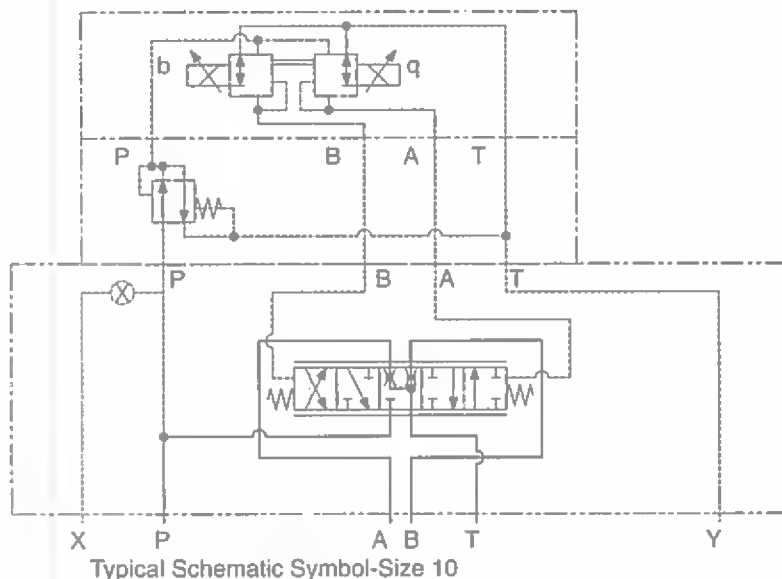
Introduction .....	B.130
Features and benefits .....	B.130
Typical section .....	B.130
Functional Symbols .....	B.132
Model Codes .....	B.133
Spool Data .....	B.134
Operating Data .....	B.135
Performance Characteristics .....	B.137
Installation Dimensions .....	B.140
Subplates, Connection Plates and Mounting Surfaces .....	B.145
Electrical Information .....	B.159
Installation Data .....	B.166
Application Data .....	B.167



## Functional Symbols



Simplified symbol  
KDG5V models  
(Spool type "2" shown)



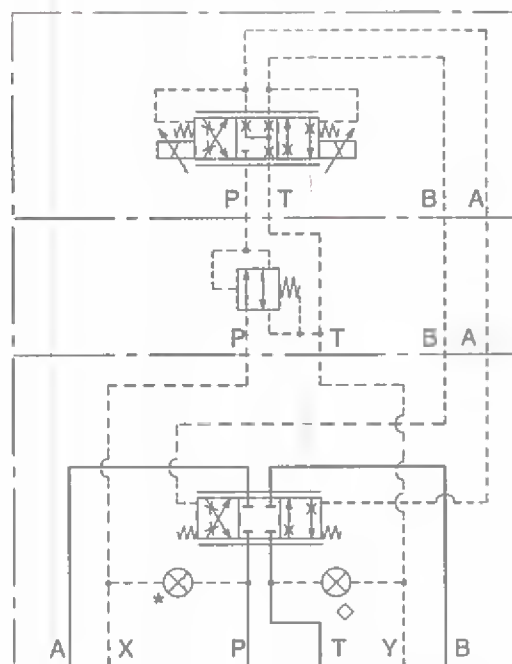
\* Internal plug shown, for external pilot supply (via port X).

For internal pilot supply (from port P) plug is not fitted. Port X should be blocked at mounting interface, or otherwise plugged at subplate or manifold block. See "Model Code".

◇ Internal plug shown, for external pilot drain (via port Y).

For internal pilot drain (via port T) plug is not fitted. Port Y should be blocked at mounting interface, or otherwise plugged at subplate or manifold block. See "Model Code".

See also "Pilot Drain Application" notes.

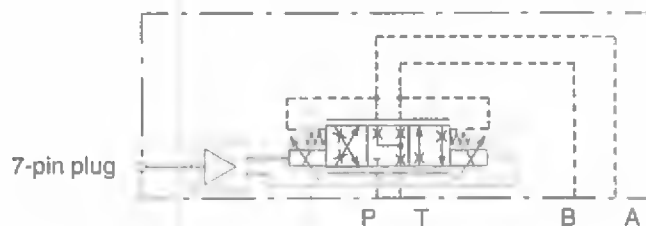


Typical Schematic Symbol-Sizes 5/7/8

Pilot stage.  
Solenoids identified  
"A"/"B" according to  
"Model Code" designation.

Pressure reducer  
module, see "Model  
Code"

Main-stage.  
Spool type "2C" shown



Pilot stage with  
integral amplifier

# Model Codes

**K(A)DG5V - \* - \*\*\* C \*\*\* N (\*\*\*) - (\*\*) - (T) - (\*) - (V) M - \*\*\*\*\* - 1 - 1\* - EN47**

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

## 1 Model Series

K- Proportional  
A- Integral amplifier, sizes 5 / 7 & 8 only  
D- Directional valve  
G- Subplate/manifold mounted  
5- Solenoid controlled/pilot operated  
V- Pressure rating 350 bar (5000 psi)  
on P, A & B ports

## 2 Mounting interface size (ISO 4401)

5 = NFPA D05, CETOP 5  
7 = NFPA D07, CETOP 7  
8 = NFPA D08, CETOP 8  
10 = NFPA D10, CETOP 10

## 3 Spool type

See "Spool Data", page B.134  
2 = All ports blocked  
when spool centered  
7 = Open P to A&B,  
12 = All ports blocked  
when spool centered,  
regenerative function  
when spool energized  
33/133 = Bleed A and B to T  
when spool centered

## 4 Spool/ spring arrangement

C = Spool spring centered

## 5 Flow rating

See "Spool Data", page B.134  
Flow rating (L/min) for symmetric  
spools: "A" port flow rating (L/min) for  
asymmetric spools

## 6 Spool metering type

N = Meter-in and meter-out

## 7 Flow rating

See "Spool Data", page B.134  
"B" port flow rating (L/min) for  
asymmetric spools

## 8 Pilot supply

Models without integral, fixed pilot  
pressure reducer module  
E = External pilot supply  
Blank=Internal pilot supply

Models with integral, fixed pilot pressure  
reducer module

X = Internal pilot supply  
EX = External pilot supply

For system pressures less than 200 bar  
(2900 psi) the pilot pressure reducing  
module is optional.

For system pressures above 200 bar  
(2900 psi) the pilot pressure reducing  
module must be fitted.

## 9 Pilot drain

T = Internal pilot drain  
Blank = External pilot drain

## 10 Manual override

Blank = Plain overrides  
H = Water-resistant overrides  
Z = No overrides

## 11 Solenoid identity

V = Solenoid "A" at port A end of pilot  
valve, solenoid "B" at B end.  
(Energizing "A" gives main-stage  
flow from port B; energizing "B"  
gives flow from port A): German  
practice.

Blank=Solenoid "A" energized for  
main-stage flow from port A;  
solenoid "B" energized for  
main-stage flow from port B: USA  
ANSI B93/NFPA standard.

## 12 Heading electrical flag symbol

M = Features and options for pilot  
valve

## 13 Electrical data and connection type

Plug connector type to ISO 4400  
(DIN 43650). For coil characteristics see  
"Operating Data" table (page B.135):  
U-G = For use with amplifier with  
12V DC supply  
U-GP = For use with 12V power  
U-H = For use with amplifier with  
24V DC supply  
U-HA = For use with 24V power plug  
U-HR = For use with 800 mA power  
supply  
F-PD7 = 7-pin connector with plastic  
plug.  
See warning note below

## 14 Pilot drain pressure

1 = Standard

(See Pilot Drain Application Notes,  
page B.137)

## 15 Design number, 10 series

Subject to change. Installation dimensions  
unaltered for design numbers 10 to 19  
respectively.

## 16 Special features

EN47 used with P type coil connection  
and Uniplug connector.  
Omit if not required



### Warning

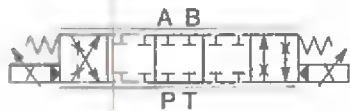
To conform to the EC Electromagnetic Compatibility directive (EMC) this KACG valve must be fitted with a metal 7-pin plug. The screen of the cable must be securely connected to the shell of the metal connector. A suitable IP67 rated connector is available from Vickers, part no. 934939. Alternatively a non IP67 rated connector is available from ITT-Cannon, part no. CA 02 COM-E 14S A7 P. The plastic plug, part number 694534, is only suitable for use in a sealed electromagnetic environment or outside of the European Community.

# Spool Data

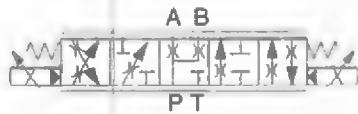
## Spool Symbols

Simplified symbols including transient flow conditions (dotted line).

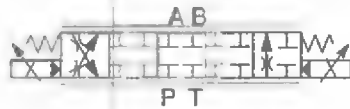
Spool type 2C



Spool type 7C



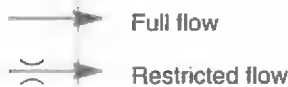
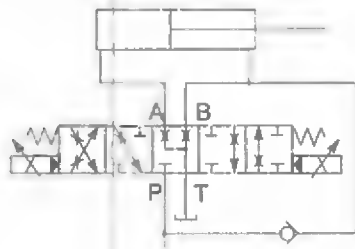
Spool type 12C



Spool type 33C



Spool type 133C, with typical regenerative circuit



## Spool Types and Flow Ratings

### Symmetric Spools

Flow ratings for flow through P-A-B-T at  $\Delta p = 5$  bar (72 psi) per flow path, e.g. P-A, or B-T. For other pressure drop values see "Flow Gain" curves on page B.138.

Spool code	Main stage spool symbol	Flow rating
For K(A)DG5V-5 valves:		
2C90N	2C	90 L/min (24 USgpm)
33C80N	33C	80 L/min (21 USgpm)
For K(A)DG5V-7 valves:		
2C180N	2C	180 L/min (48 USgpm)
33C170N	33C	170 L/min (45 USgpm)
For K(A)DG5V-8 valves:		
2C280N	2C	280 L/min (74 USgpm)
33C270N	33C	270 L/min (71 USgpm)
For KDG5V-10 valves:		
2C550N	2C	550 L/min (145 USgpm)
7C550N	7C	550 L/min (145 USgpm)
12C550N	12C	550 L/min (145 USgpm)
33C550N	33C	550 L/min (145 USgpm)
133C550N	133C	550 L/min (145 USgpm)

### Asymmetric Spools

Figure preceding metering type designator, "N" (e.g. 2C\*\*\*N) is flow rating P-A, or A-T ("A" port flow); figure after "N" (N\*\*\*) is flow rating P-B, or B-T ("B" port flow).

Spool code	Main stage spool symbol	Flow rating
For K(A)DG5V-5 valves:		
2C70N45	2C	70 L/min (18.5 USgpm), "A" port flow 45 L/min (12 USgpm), "B" port flow
For K(A)DG5V-7 valves:		
2C180N100	2C	180 L/min (48 USgpm), "A" port flow 100 L/min (26 USgpm), "B" port flow
For K(A)DG5V-8 valves:		
33C250N170	33C	250 L/min (66 USgpm), "A" port flow 170 L/min (45 USgpm), "B" port flow
133C250N170	133C	250 L/min (66 USgpm), "A" port flow 170 L/min (45 USgpm), "B" port flow
For KDG5V-10 valves:		
2C310N550	2C	310 L/min (82 USgpm), "A" port flow 550 L/min (145 USgpm), "B" port flow
2C550N310	2C	550 L/min (145 USgpm), "A" port flow 310 L/min (82 USgpm), "B" port flow
33C310N550	33C	310 L/min (82 USgpm), "A" port flow 550 L/min (145 USgpm), "B" port flow
33C550N310	33C	550 L/min (145 USgpm), "A" port flow 310 L/min (82 USgpm), "B" port flow

Relative duty factor	Continuous rating (ED = 100%)
Mass:	
KBHDG5V-5	10,15 kg (22.4 lb) approx.
KBHDG5V-7	11,4 kg (25.1 lb) approx.
Valves without pressure reducer (no "X" in model code)	
KBHDG5V-5	8,85 kg (19.5 lb) approx.
KBHDG5V-7	10,1 kg (22.2 lb) approx.
Supporting products:	
Auxiliary electronic modules (DIN -rail mounting):	
EHA-CON-201-A2* signal converter	See catalog GB 2410A
EHD-DSG-201-A-1* command signal generator	See catalog GB 2470
EHA-RMP-201-A-2* Ramp generator	See catalog GB 2410A
EHA-PSU-201-A-10 Power supply	See catalog GB 2410A
EHA-PID-201-A-20 PID controller	See catalog GB 2427

## Pressures and Flow Rates

### Maximum pressures, bar (psi)

#### Valves with pressure reducer

Model	Pilot pressure source <sup>⊕</sup>	Pilot drain connection	P Port	A&B Ports	T Port	X Port <sup>⊙</sup>	Y Port
KBHDG5V-5	External	External	310 (4500)	310 (4500)	210 (3000)	210 (3000)	50 (700)
		Internal*	310 (4500)	310 (4500)	50 (700)	310 (4500)	50 (700)
	Internal	External	310 (4500)	310 (4500)	100 (1500)	310 (4500)	50 (700)
		Internal*	310 (4500)	310 (4500)	50 (700)	310 (4500)	50 (700)
KBHDG5V-7	External	External	350 (5000)	350 (5000)	350 (5000)	350 (5000)	50 (700)
		Internal*	350 (5000)	350 (5000)	50 (700)	350 (5000)	50 (700)
	Internal	External	350 (5000)	350 (5000)	350 (5000)	350 (5000)	50 (700)
		Internal*	350 (5000)	350 (5000)	50 (700)	350 (5000)	50 (700)

⊕ Minimum pilot operating pressure = 50 bar (700 psi)

\* Internal drain is a non-preferred option

⊙ For pilot pressures ≤ 210 bar (3000 psi) a pilot pressure reducer is optional

For pilot pressures > 210 bar (3000 psi) a pilot pressure reducer must be used

Unused pilot port: Maximum pressure as shown

**Maximum pressures, bar (psi)**  
**Valves without pressure reducer**

Model	Pilot pressure source⊕	Pilot drain connection	P Port	A&B Ports	T Port	X Port⊖	Y Port
KBHDG5V-5	External	External	310 (4500)	310 (4500)	210 (3000)	210 (3000)	50 (700)
		Internal*	210 (3000)	310 (4500)	50 (700)	210 (3000)	50 (700)
	Internal	External	210 (3000)	310 (4500)	210 (3000)	210 (3000)	50 (700)
		Internal*	310 (4500)	310 (4500)	50 (700)	210 (3000)	50 (700)
KBHDG5V-7	External	External	350 (5000)	350 (5000)	350 (5000)	210 (3000)	50 (700)
		Internal*	350 (5000)	350 (5000)	50 (700)	210 (3000)	50 (700)
	Internal	External	210 (3000)	350 (5000)	350 (5000)	210 (3000)	50 (700)
		Internal*	210 (3000)	350 (5000)	50 (700)	210 (3000)	50 (700)

⊕ Minimum pilot operating pressure = 50 bar (700 psi)

\* Internal drain is a non-preferred option

⊖ For pilot pressures ≤ 210 bar (3000 psi) a pilot pressure reducer is optional

For pilot pressures > 210 bar (3000 psi) a pilot pressure reducer must be used

Unused pilot port: Maximum pressure as shown

**Minimum recommended flow rates**

For spool types 2C and 33C

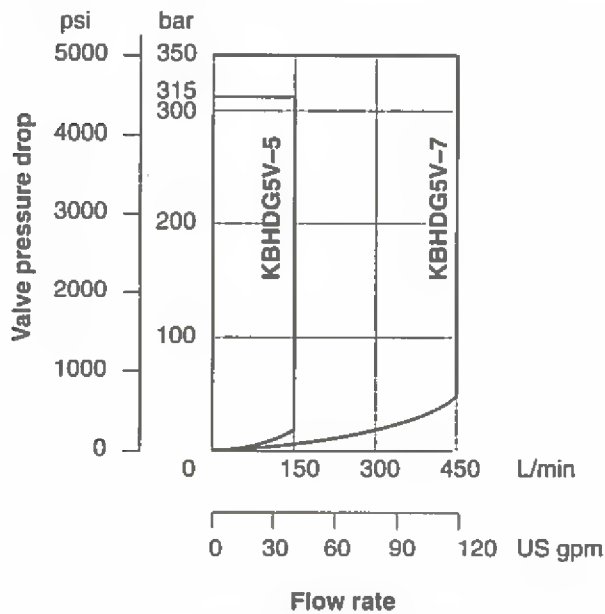
Δp = 10 bar (145 psi) for looped flow P-A-B-T (or P-B-A-T)

Valve Size/Spool Code	Min. Flow Rate L/min	in <sup>3</sup> /min
KBHDG5V-5-2C100N	0,5	30
KBHDG5V-5-33C80N	0,5	30
KBHDG5V-7-2C200N	1,0	60
KBHDG5V-7-33C160N	1,0	60

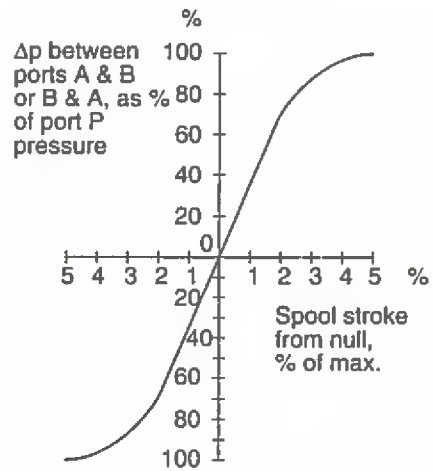
# Performance Curves

## Power Capacity Envelope

Flow through P-A-B-T or P-B-A-T

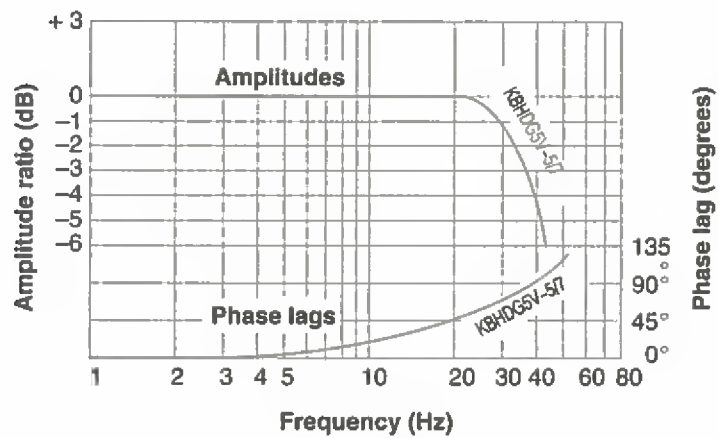


## Pressure Gain ("5C" spools only)



## Frequency Response, Typical

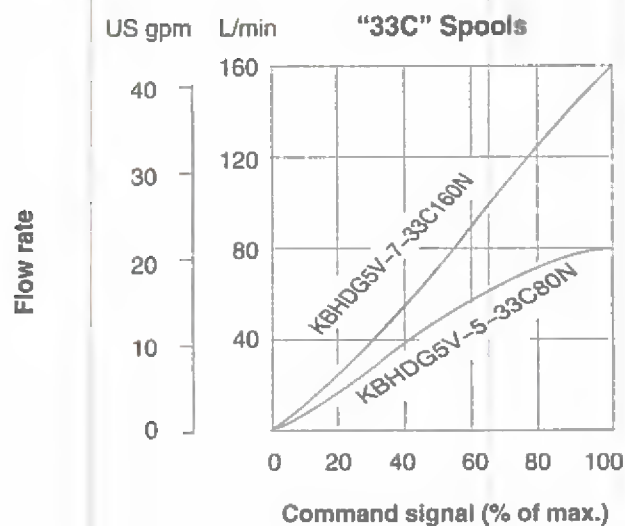
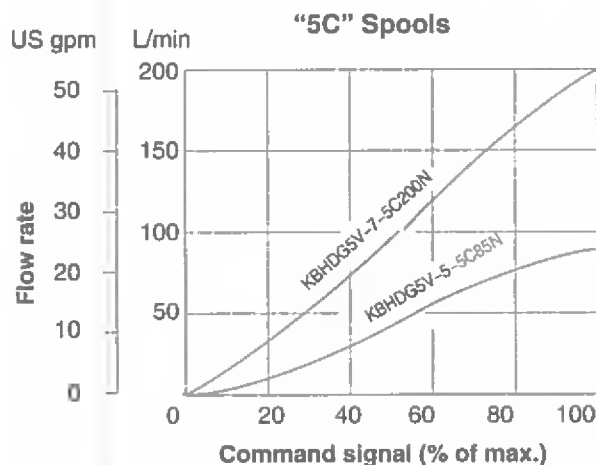
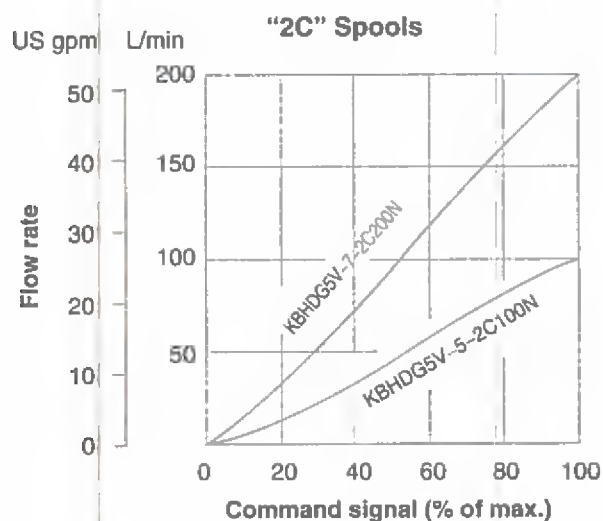
For an amplitude of  $\pm 25\%$  of max. stroke (center-to-offset) about the 50% position





## Flow gain

At  $\Delta p = 5$  bar (72 psi) per metering path (e.g. P-A), with flow through P-A-B-T or P-B-A-T. Percentage command signals applicable for positive and negative values of command signal.



At other  $\Delta p$  values, flow rates approximate to:

$$Q_x = Q_D \sqrt{\frac{\Delta p_x}{\Delta p_D}}$$

where  $Q_D$  = Datum flow rate  
 $\Delta p_D$  = Pressure drop at datum flow rate  
 $\Delta p_x$  = Required  $\Delta p$

Limited by valve power capacity.  
Refer to curves on page B.121.

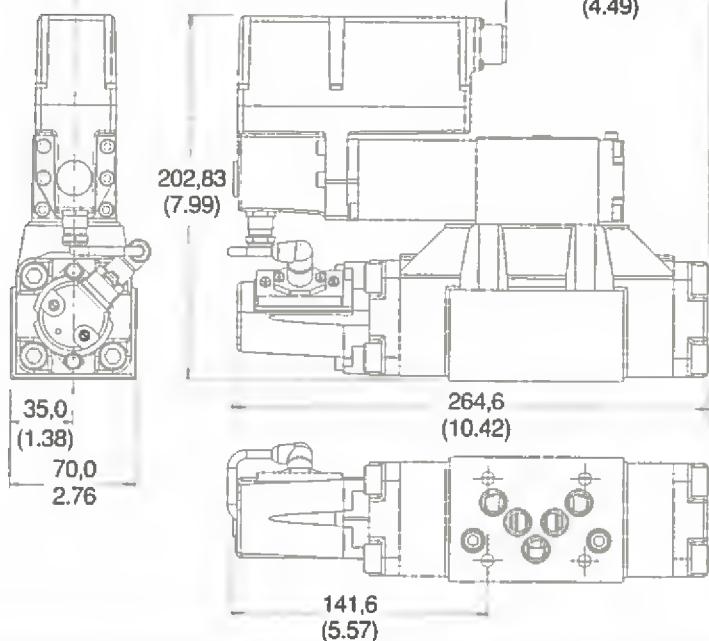
# Installation Dimensions

## KBH5G5V-5

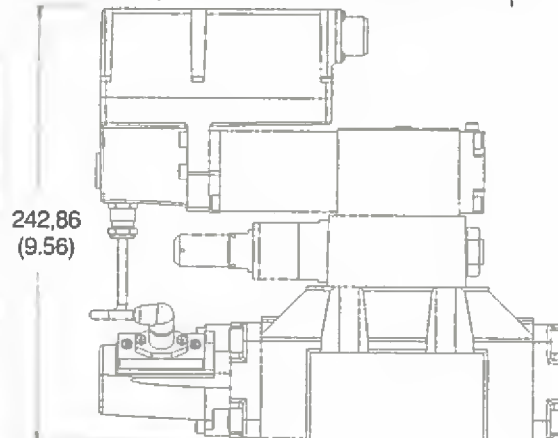
mm (inch)

3rd angle projection

Valve without pressure reducer



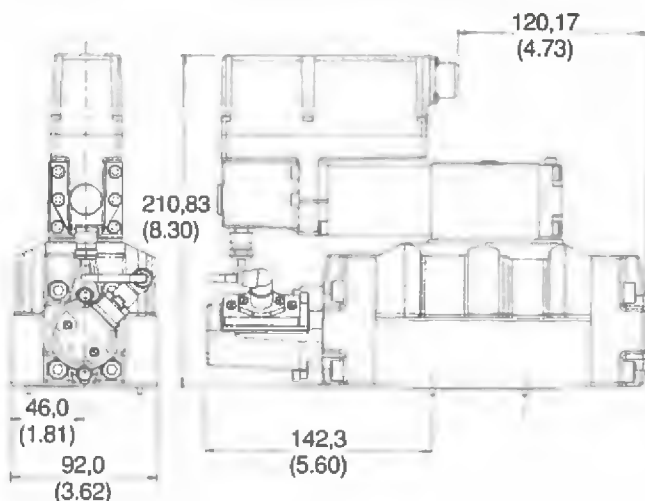
Valve with pressure reducer



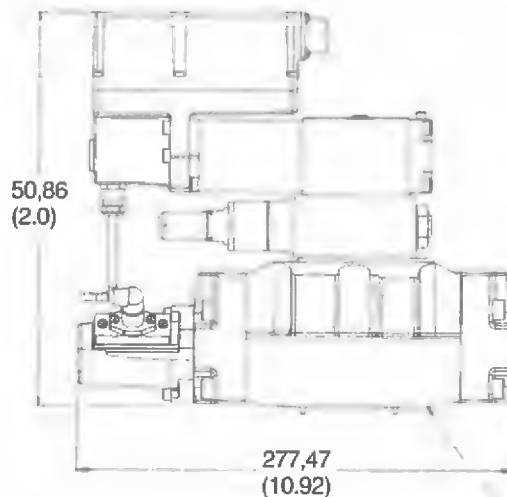
Mounting surface, seals supplied. For mating surface dimensions and subplate options, see page B.125 (size 05 with additional X and Y ports). For mounting bolt options, see page B.128.

## KBH5G5V-7

Valve without pressure reducer



Valve with pressure reducer



Mounting surface, seals supplied. For mating surface dimensions and subplate options, see page B.125. For mounting bolt options, see page B.128.

# Subplates and Mounting Surfaces

## General Description

When a subplate is not used, a machined pad must be provided for valve mounting. Pad must be flat within 0,0127 mm (0,0005 inch) and smooth within 1,6  $\mu$ m (63 microinch). Mounting bolts, when provided by customer, should be ISO 898 class 12.9 or better.

Bolt Kits See page B.128.

## Dimensional Tolerances

Dimensional tolerance on interface drawings is  $\pm 0,2$  mm ( $\pm 0,008$ " ) except where otherwise stated. ISO 4401 specifies inch conversion to  $\pm 0,01$ ".

## Conversion from Metric

ISO 4401 gives dimensions in mm. Inch conversions are accurate to 0.01" unless otherwise stated.

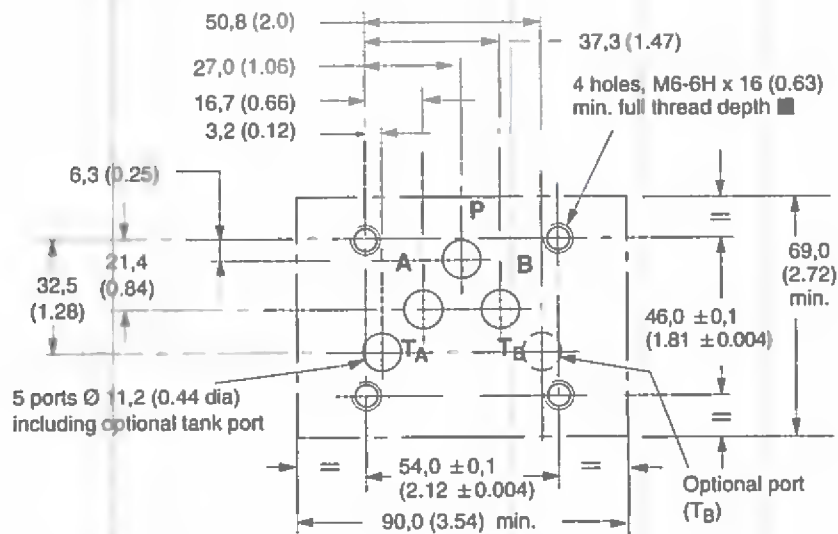
## Mounting Bolt Tappings

ISO 4401 gives metric thread tappings. Alternate UNC tappings are Vickers recommendations that allow these plates and associated valves to be used up to their maximum pressures, when using Vickers recommended bolt kits, or bolts of an equivalent strength. It is recommended that Customer's own manifold blocks for UNC bolts should be tapped to the minimum depths given in the footnotes.

## Mounting Surface Interface to ISO 4401

### Size 05

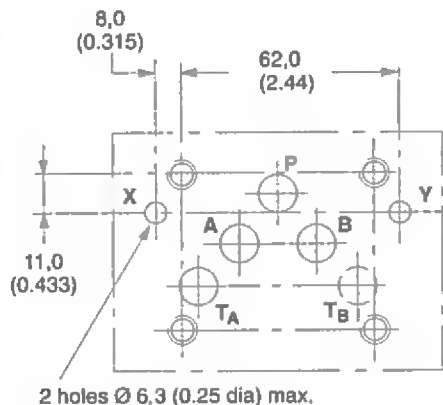
This interface conforms to: ISO 4401-05-04-0-94, ANSI/B93.7M (and NFPA) size 05, CETOP R35H4.2-05, DIN 24340 Form A10



■ 1/4"-20 UNC-2B optional.

### Interface with Additional Pilot Ports X and Y

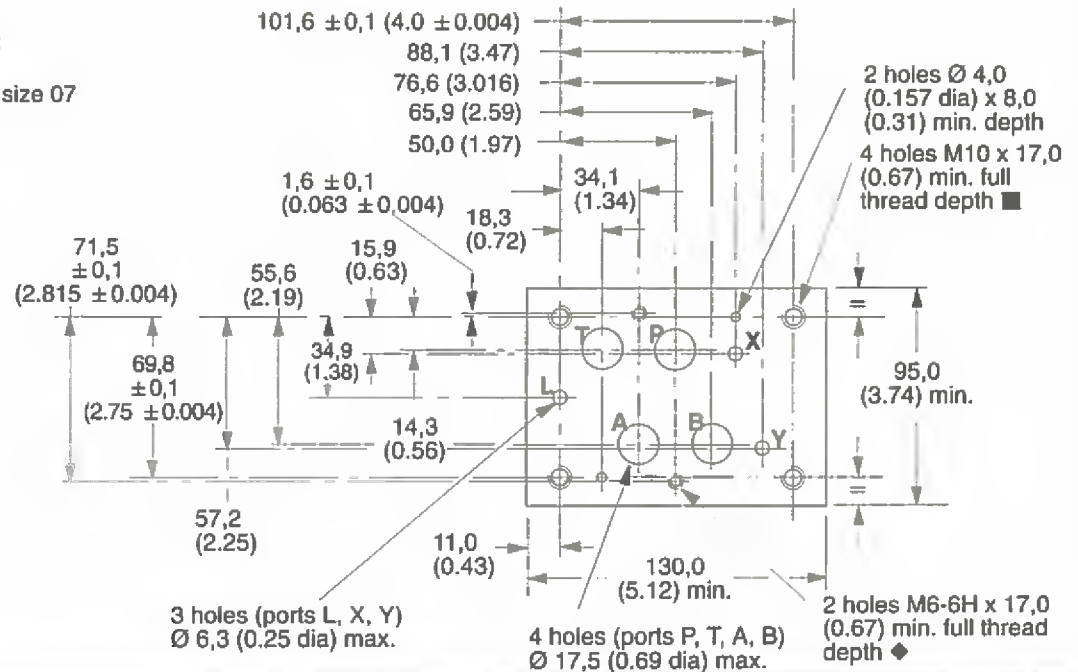
The interface conforms to Vickers standard, plus holes X and Y ISO 4401-05-05-0-94



## Size 07

This interface conforms to:  
ISO 4401-07-06-0-94  
ANSI/B93.7M (and NFPA) size 07  
CETOP R35H4.3-07  
DIN 24340 Form A16

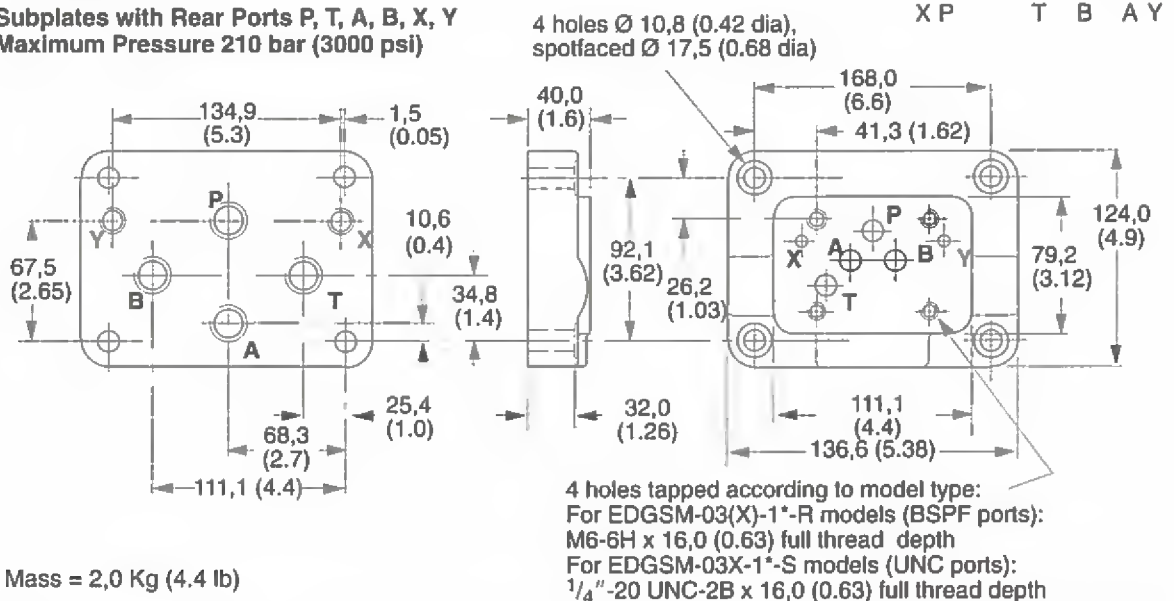
- $\frac{3}{8}$ " -16 UNC optional.
- ◆  $\frac{1}{4}$ " -20 UNC optional.



## Subplates

EDGSM-03-1\*-R  
EDGSM-03X-1\*-R  
EDGSM-03X-1\*-S

Subplates with Rear Ports P, T, A, B, X, Y  
Maximum Pressure 210 bar (3000 psi)



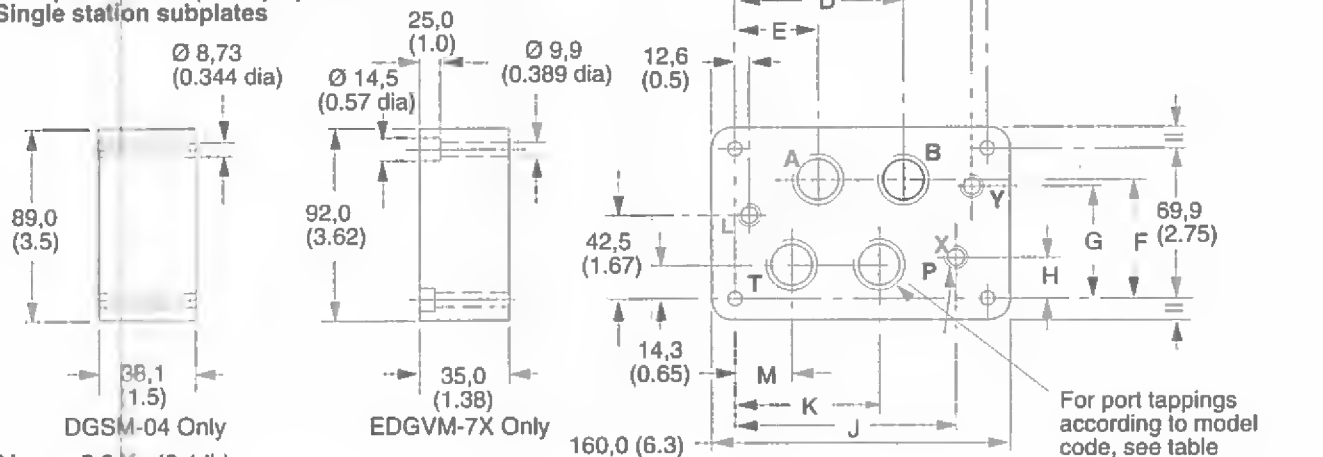
Mass = 2,0 Kg (4.4 lb)

### Port Threads

Model	Ports P, T, A, B	Ports X, Y
EDGSM-03(X)-1*-R	G $\frac{1}{2}$ (1/2" BSPF) x 14,0 (0.55) full thread depth	G $\frac{1}{4}$ (1/4" BSPF) x 12,2 (0.48) full thread depth
EDGSM-03X-1*-S	1 $\frac{1}{16}$ " -12 UN-2B x 16,0 (0.63) full thread depth	$\frac{9}{16}$ " -18 UNF-2B x 12,7 (0.5) full thread depth

**DGSM-04-12S-2\* (UNF/SAE port threads; UNC mounting bolts)**  
For up to 210 bar (3000 psi) Maximum Pressure

**EDGVM-7X-D-1\*-R (BSPF port threads; metric mounting bolts)**  
For up to 350 bar (5000 psi) Maximum Pressure  
Single station subplates



Mass = 3,8 Kg (8.4 lb)

#### Port and Bolt Threads

Model	Ports P, T, A, B	Ports L, X, Y	Mounting bolt tapping
DGSM-04-12S-2*	1 1/16"-12 UNF-2B x 19,1 (0.75) full thread depth	9/16"-18 UNF-2B x 12,7 (0.5) full thread depth	4 x 3/8"-16 UNC 2 x 1/4"-20 UNC
EDGVM-7X-D-1*-R	G3/4 (3/4" BSPF) x 16,0 (0.63) full thread depth	G1/4 (1/4" BSPF) x 12,0 (0.47) full thread depth	4 x M10 2 x M6

Model (Dimensions)	C	D	E	F	G	H	J	K	M
DGSM-04-12S-2*	121,4 (4.78)	88,4 (3.48)	44,2 (1.74)	56,6 (2.23)	54,9 (2.16)	18,3 (0.72)	121,4 (4.78)	76,7 (3.02)	32,3 (1.27)
EDGVM-7X-D-1*-R	128,6 (5.06)	93,6 (3.68)	50,6 (1.99)	55,6 (2.19)	52,0 (2.05)	15,9 (0.63)	113,6 (4.47)	79,6 (3.13)	36,6 (1.44)

## Electrical Information

### Electrical Block Diagram Command Signals and Outputs

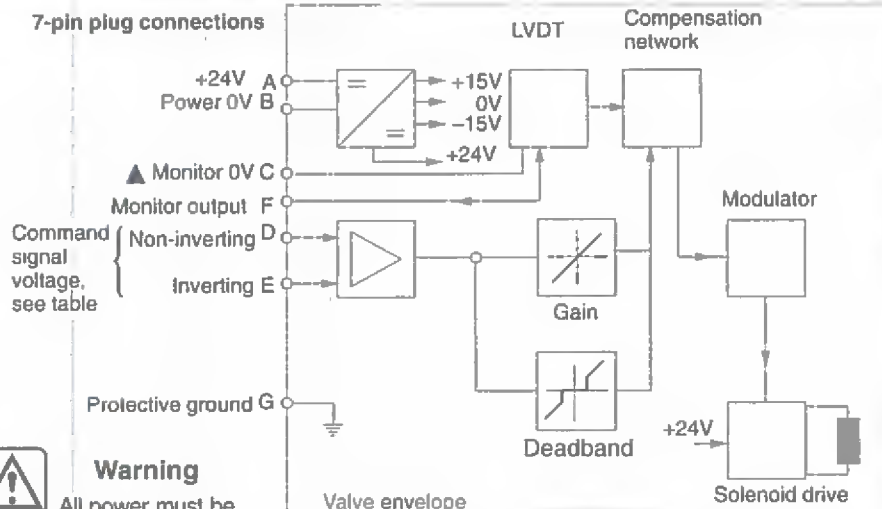
7-pin plug		Flow direction
Pin D	Pin E	
Positive	OV	P to A
OV	Negative	
U <sub>D</sub> · U <sub>E</sub> = Positive		
Negative	OV	P to B
OV	Positive	
U <sub>D</sub> · U <sub>E</sub> = Negative		

#### Wiring

Connections must be made via the 7-pin plug mounted on the amplifier. See page B.99 of this leaflet and Installation and Start-up Guidelines, ML-B-9090A for cable recommendations.



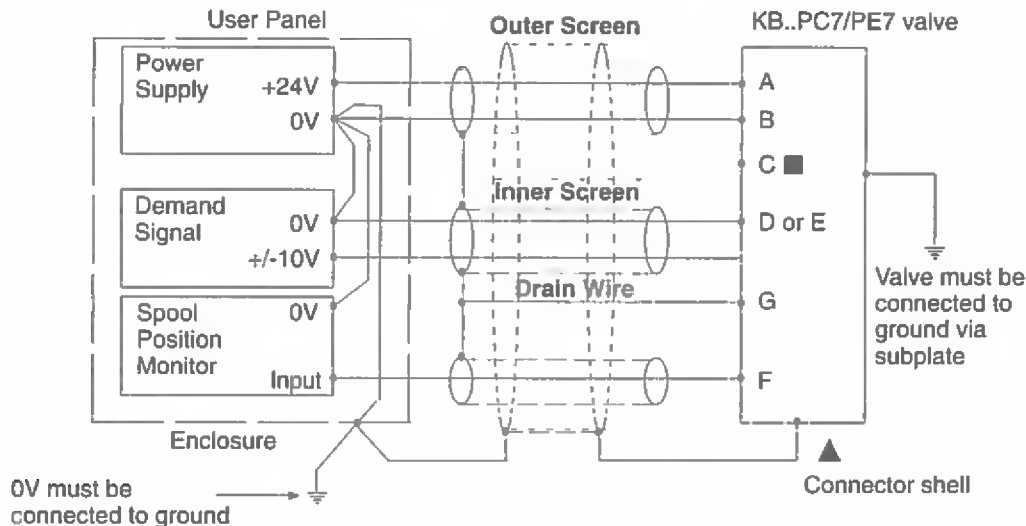
**Warning**  
All power must be switched off before connecting or disconnecting any plugs.



▲ Note: In valves with PH7 or PR7 type electrical connection, pin C is used for a valve enable signal.

# Typical Connection Arrangements

## Wiring Connections



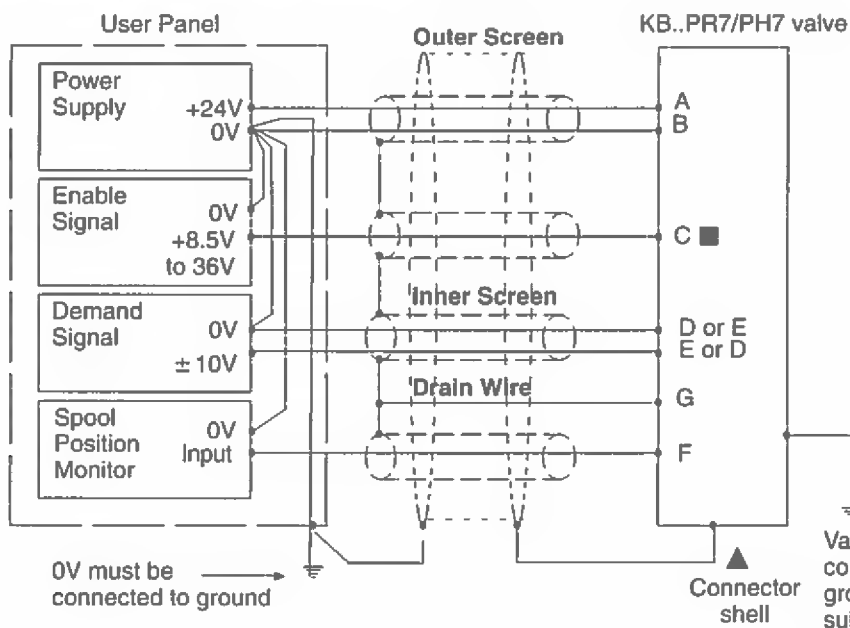
■ Spool position monitor voltage (pin F) will be referenced to the KB valve local ground. A "local ground" (pin C) is provided on PC7/PE7 versions for optional use by differential input customer supplied electronics.



### WARNING

Do not ground pin C. If the local ground (pin C) is not used for differential monitor electronics, do not use. Read monitor pin F with respect to ground.

## Wiring Connections for Valves with Enable Feature



### ▲ Note:

In applications where the valve must conform to European RFI/EMC regulations, the outer screen (shield) must be connected to the outer shell of the 7 pin connector, and the valve body must be fastened to the earth ground. Proper earth grounding practices must be observed in this case, as any differences in command source and valve ground potentials will result in a screen (shield) ground loop.



### Warning

#### Electromagnetic Compatibility (EMC)

It is necessary to ensure that the valve is wired up as above. For effective protection the user electrical cabinet, the valve subplate or manifold and the cable screens should be connected to efficient ground points. The metal 7 pin connector part no. 934939 should be used for the integral amplifier.

In all cases both valve and cable should be kept as far away as possible from any sources of electromagnetic radiation such as cables carrying heavy current, relays and certain kinds of portable radio transmitters, etc. Difficult environments could mean that extra screening may be necessary to avoid the interference.

It is important to connect the 0V lines as shown above. The multi-core cable should have at least two screens to separate the demand signal and monitor output from the power lines.

The enable line to pin C should be outside the screen which contains the demand signal cables.



# Application Data

## Fluid Cleanliness

Proper fluid condition is essential for long and satisfactory life of hydraulic components and systems. Hydraulic fluid must have the correct balance of cleanliness, materials and additives for protection against wear of components, elevated viscosity and inclusion of air.

Recommendations on contamination control methods and the selection of products to control fluid condition are included in Vickers publication 9132 or 561, "Vickers Guide to Systemic Contamination Control". The book also includes information on the Vickers concept of "ProActive Maintenance". The following recommendations are based on ISO cleanliness levels at 2 µm, 5 µm and 15 µm.

For products in this catalog the recommended levels are:  
0 to 70 bar (1000 psi) ..... 18/16/13  
70 + bar (1000 + psi) ..... 17/15/12

Vickers products, as any components, will operate with apparent satisfaction in fluids with higher cleanliness codes than those described. Other manufacturers will often recommend levels above those specified.

Experience has shown, however, that life of any hydraulic components is shortened in fluids with higher cleanliness codes than those listed above. These codes have been proven to provide a long trouble-free service life for the products shown, regardless of the manufacturer.

## Hydraulic Fluids

Materials and seals used in these valves are compatible with antiwear hydraulic oils, and non-alkyl-based phosphate esters. The extreme operating viscosity range is 500 to 13 cSt (2270 to 70 SUS) but the recommended running range is 54 to 13 cSt (245 to 70 SUS). For further technical information about fluids see "Technical Information" leaflet B-920 or I-286S.

## Installation

The proportional valves in this catalog can be mounted in any attitude, but it may be necessary in certain demanding applications, to ensure that the solenoids are kept full of hydraulic fluid. Good installation practice dictates that the tank port and any drain port are piped so as to keep the valves full of fluid once the system start-up has been completed.

## Mounting Bolt Kits

**For KBHGD5V-5**  
BKDG01633M (metric)  
BKDG01633 (inch)

**For KBHGD5V-7**  
BKDG7 858918 (metric)  
BK590724 (inch)

*If not using Vickers recommended bolt kits, bolts used should be to ISO 898, 12.9 or better.*

## Seal Kits

KBHGD5V-5 ..... 02-350518  
KBHGD5V-7 ..... 02-350519

## Plugs

KBHGD5V  
7-pin plug (metal) ..... 934939  
7-pin plug (plastic) ..... 694534  
(metal plug must be used for full EMC protection)

**NOTE:** An alternative metal connector which gives EMC protection but not IP67 rating is available from ITT-Cannon, part number CA06-COM-E-14S-A7-S.

## Extension Cable

**Extension Cable:** Adapter for extending 7 core cable when changing from KA to KB valve and existing wiring is not long enough. Consists of a 7 pin plug, a 7 pin socket and a length of cable, fully assembled for ease of use  
Extension Cable ..... 944450

## Service Information

The products from this range are preset at the factory for optimum performance; disassembling critical items would destroy these settings. It is therefore recommended that should any mechanical or electronic repair be necessary they should be returned to the nearest Vickers repair center. The products will be refurbished as necessary and retested to specification before return.

Field repair is restricted to the replacement of the seals.

*Note: The feedback/solenoid assembly installed in this valve should not be disassembled.*

# Operating Data

Data is typical:  
With fluid at 36 cSt (168 SUS) and 50°C (122°F).  
Using recommended Vickers amplifier to drive KDG5V models.

## KDG5V valves

Installation and Start-up Guidelines	ML-B-9046	
Max. solenoid current Coil type:		
U-G	3.5A	
U-GP	3.0A	
U-H	1.6A	
U-HA	0.94A	
U-HR	0.8A	
Coil resistance Coil type:	At 20°C (68°F)	Max. operating
U-G	1.65Ω	2.66Ω
U-GP	2.0Ω	3.1Ω
U-H	7.3 Ω	11.3 Ω
U-HA	22.1Ω	34.6Ω
U-HR	19.1Ω	29.9Ω
Coil inductance measured at 1000 Hz and 150 mV Coil type:		
U-G	4 mH	
U-GP	6 mH	
U-H	19 mH	
U-HA	55 mH	
U-HR	51 mH	
Hysteresis Size 5/7/8 Size 10	± 4% of rated max. flow <6% of rated max. flow	Size 5/7/8 Size 10
Repeatability: Size 5/7/8 Size 10	<3% 8%	
Relative duty factor	Continuous rating (ED = 100%)	
Type of electrical protection, with electrical plugs fitted correctly	IEC 144 Class IP65	
Electrical connection	ISO 4400 (DIN 43650)	
Recommended drive amplifier	Vickers Eurocard type: EEA-PAM-520-A-14 (one ramp), or EEA-PAM-523-A-32 (two ramps)	

**KADG5V-5/7/8 Valves with Integral Amplifiers**

Power supply	24V DC (21V to 36V including 10% peak-to-peak max. ripple) max. current 3A
Command signal	± 10V DC
Input impedance	47 kΩ
7-pin plug connector	
Pin connections:	
A	Power supply +ve
B	Power 0V
C	Signal 0V
D	+ve voltage command signal
E	-ve voltage command signal
F	Monitor output
G	Protective ground
Electro-magnetic compatibility (EMC):	
Emission (10 v/m)	EN 50081-2
Immunity (10 v/m)	EN 50082-2
Gain adjustment	25 to 125%
Factory set adjustments	Deadband, gain, dither and offset
Monitor point signal	0,5V per amp solenoid current
Output impedance	10 kΩ
Power stage PWM frequency	2 kHz nominal
Reproducibility, valve-to-valve (at factory settings):	
Flow gain at 100% command signal	<3% of rated flow
Protection:	
Electrical	Reverse polarity protected
Mechanical	IEC 144, Class IP65
Relative humidity	65 to 85% at 20 to 70°C (68 to 158°F)
Supporting products:	
Auxiliary electronic modules (DIN-rail mounting):	
EHA-CON-201-A-2* signal converter	
EHD-DSG-201-A-1* command signal generator	
EHA-RMP-201-A-2* ramp generator	
EHA-PID-201-A-2* PID controller	

# Performance Characteristics

Data is typical with fluid at 36 cSt (168 SUS) and 50°C (122°F), using Vickers recommended amplifier to drive KDG5V models.

## Minimum Pressure

For full flow performance pilot pressure

≥ 45 bar (650 psi), i.e.:

Pressure at port P for internal pilot supply ("X" or omit in model code).

Pressure at port X for external pilot supply ("E" or "EX" in model code).

## Pilot Drain Application Notes

External pilot drain is to recommended configuration.

Internal pilot drain is possible where a stable "T" port pressure, not exceeding 8 bar (116 psi), can be guaranteed.



Any pressure surges at the "T" port (drain) will cause the main spool to move and change the valve output. This possibility is eliminated by the use of an external drain.

## Maximum Pressures, bar (psi)

### For models without integral pilot pressure reducer

Model	Pilot Pressure Source	Model code	P,A,B	Ports T	X	Y*
KDG5V-5	External	E	315 (4500)	210 (3000)	200 (2900)	8 (116)
	Internal	Omit	200● (2900)	210 (3000)	◆	8 (116)
KDG5V-7/8	External	E	350 (5000)	350 (5000)	200 (2900)	8 (116)
	Internal	Omit	200● (2900)	350 (5000)	◆	8 (116)
KDG5V-10	External	E	350 (5000)	350 (5000)	210 (3000)	8 (116)
	Internal	Omit	200 (2900)	350* (5000)	◆	8 (116)

### For models with integral pilot pressure reducer

KDG5V-5	External	EX	315 (4500)	210 (3000)	315 (4500)	8 (116)
	Internal	X	315 (4500)	210 (3000)	◆	8 (116)
KDG5V-7/8	External	EX	350 (5000)	350 (5000)	315 (4500)	8 (116)
	Internal	X	315● (4500)	350 (5000)	◆	8 (116)
KDG5V-10	External	EX	350 (5000)	350* (5000)	315 (4500)	8 (116)
	Internal	X	315 (4500)	350 (5000)	◆	8 (116)

◆ When using internal pilot pressure, port X should be plugged at the subplate or manifold face (e.g. manifold not drilled for connection to port X).

● The maximum pressure for ports A and B is: 315 bar (4500 psi) for size 5; 350 bar (5000 psi) for sizes 7, 8 and 10.

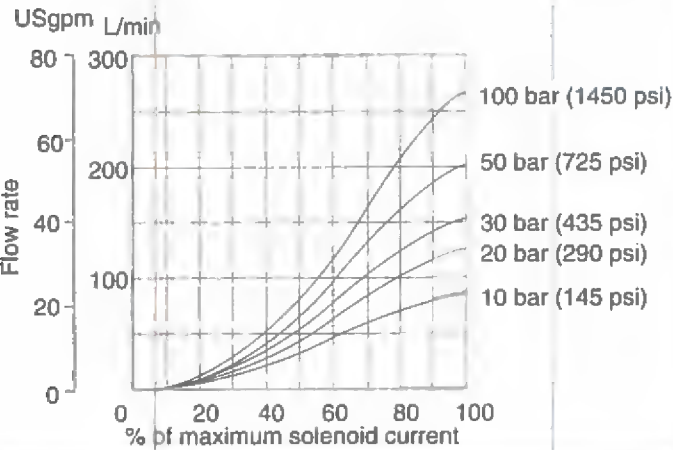
\* See "Pilot Drain Application" note.

\*-Pilot must be externally drained, otherwise "Y" port pressure applies.

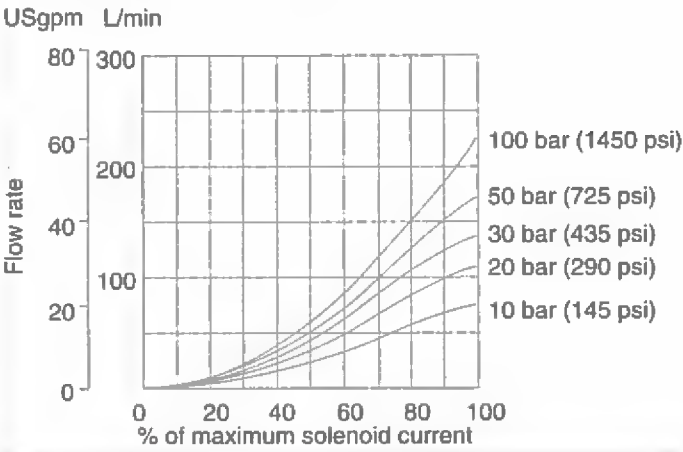
# Performance Curves

**Flow Gain**  
Flow gain curves at stated values of total valve pressure drop, for flow P-A-B-T, or P-B-A-T.

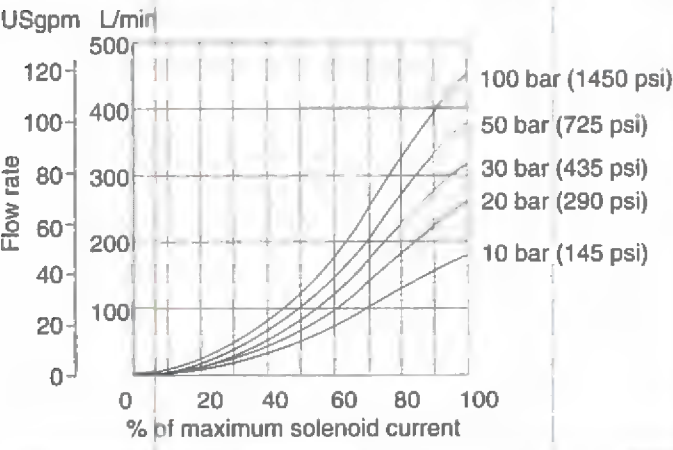
**KDG5V-5-2C90N**



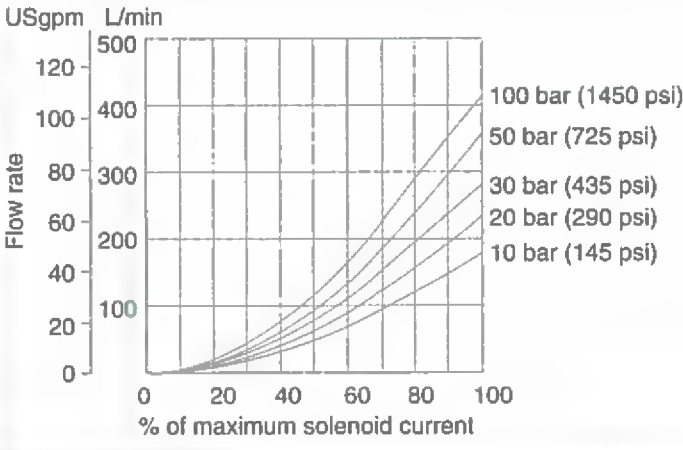
**KDG5V-5-33C80N**



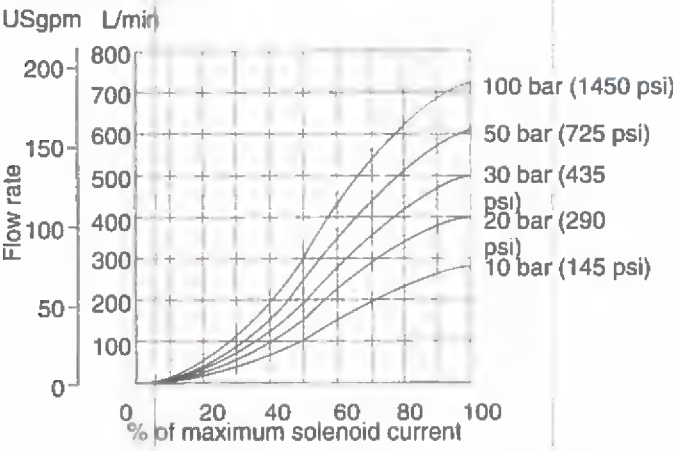
**KDG5V-7-2C180N**



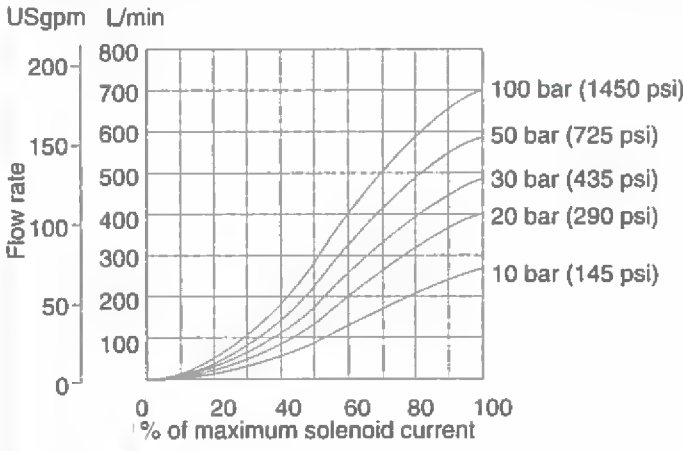
**KDG5V-7-33C170N**



**KDG5V-8-2C280N**

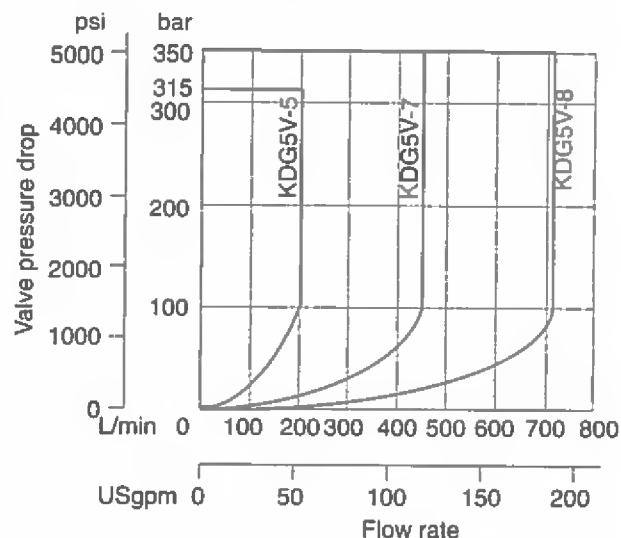
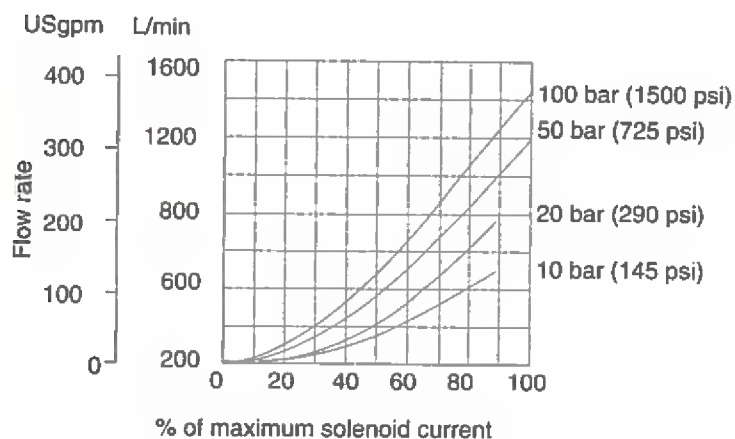


**KDG5V-8-33C270N**



# KDG5V-10

## Power Capacity Envelopes Flow through P-A-B-T or P-B-A-T



Subject to maximum pressure limitations according to model type; see "Maximum Pressures".

### Typical Step Response

Test conditions:  
No pressure reducer module  
Flow P-A-B-T

Total valve  $\Delta p$  = 10 bar (145 psi)  
Pilot pressure = 50 bar (725 psi)  
"Response" = Time, from step response signal, until output reaches 90% of step change value

### Input signal step change

### Spool response times (ms)

	KDG5V-5	KDG5V-7	KDG5V-8	KDG5V-10
0 to 100%	48	61	80	206
100% to 0	38	43	40	182
10% to 90%	42	58	66	
90% to 10%	50	58	54	
25% to 75%	30	47	49	
75% to 25%	50	58	66	
90% to 90%	70	87	98	
0% to 75%				170
75% to 0%				175
0% to 50%				160
50% to 0%				160
0% to 25%				124
25% to 0%				124

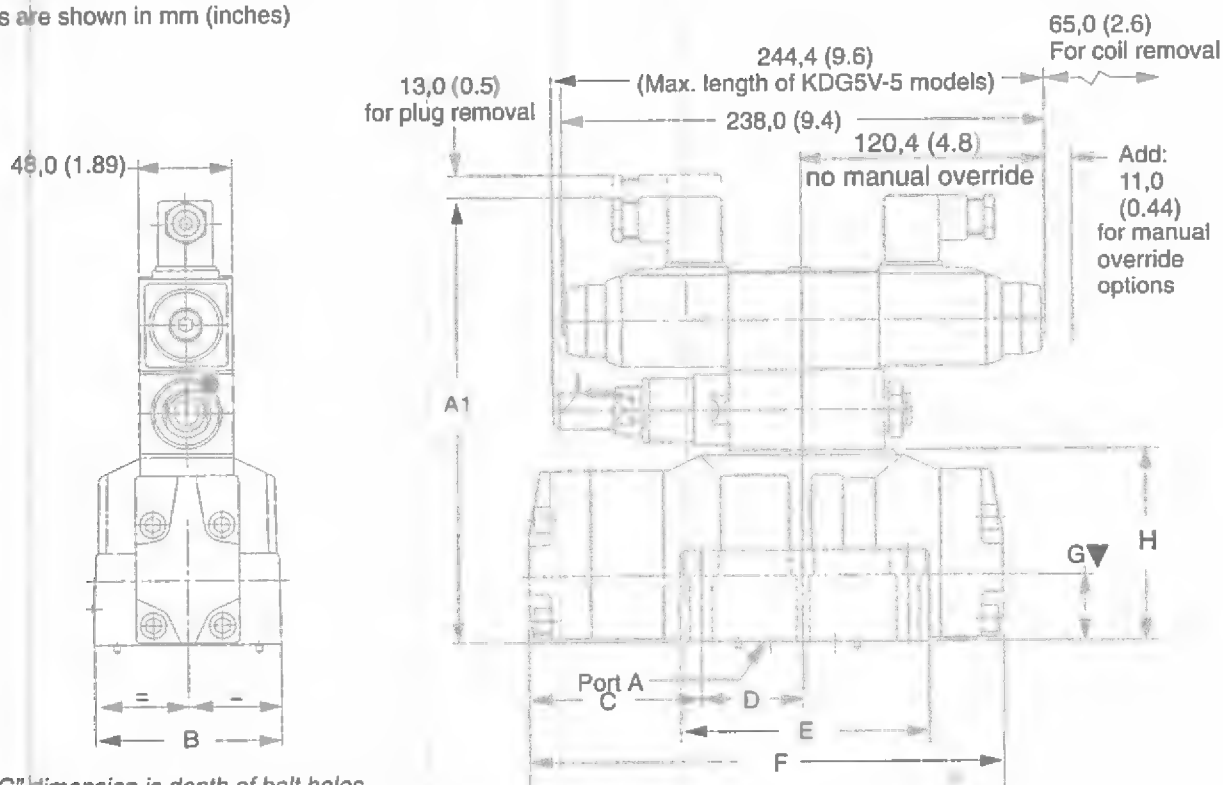
### Pilot flow required to achieve above response times:

KDG5V-5	KDG5V-7	KDG5V-8	KDG5V-10
2,7 L/min (0.7 USgpm)	4,2 L/min (1.1 USgpm)	7,5 L/min (2.0 USgpm)	18,75 L/min (5.0 USgpm)



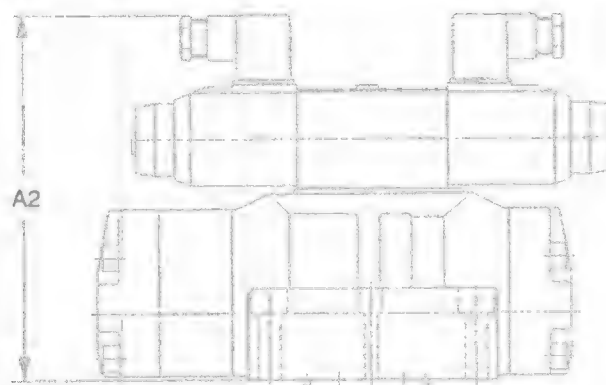
# Installation Dimensions

**KDG5V Models with "EX" or "X"**  
(With integral pilot pressure reducer)  
The illustration is correct for KDG5V-7 valves  
Dimensions are shown in mm (inches)



▼ "G" dimension is depth of bolt holes.  
(On KDG5V-7 only, this coincides with the height to the center line of the main-stage spool).

**KDG5V Models with "E" or No Symbol**  
(Without integral pilot pressure reducer)



Model	A1	A2	B	C	D	E	F	G	H
KDG5V-5	215,0 (8.47)	175,0 (6.9)	70, (2.77)	94,4 (3.72)	27,0 (1.06)	98, (3.86)	217,0 (8.54)	30,0 (1.18)	87,3 (3.4)
KDG5V-7	223,0 (8.8)	183,0 (7.2)	92,8 (3.65)	83,3 (3.3)	50,0 (1.97)	124,0 (4.88)	232,0 (9.14)	33,0 (1.3)	95,1 (3.7)
KDG5V-8	255,0 (10.1)	215,0 (8.47)	114,8 (4.52)	118,4 (4.66)	77,0 (3.03)	185,0 (7.28)	332,0 (13.1)	59,0 (2.32)	127,2 (5.0)

**KADG5V-5/7/8 models fitted with integral amplifier**

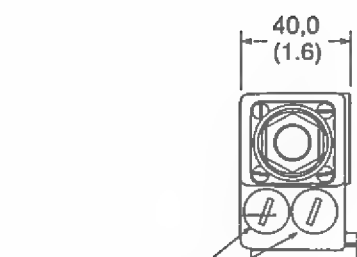
**Metal plug 934939**

Cable outside diameter 8,0 to 10,5 (0.31 to 0.41)

Must be used for full EMC protection. See also warning note on page B.160.

**Plastic plug 694534**

PG11. Cable maximum outside diameter 11,0 (0.43)



Do not remove  
these plugs.



25,0  
(1.0)

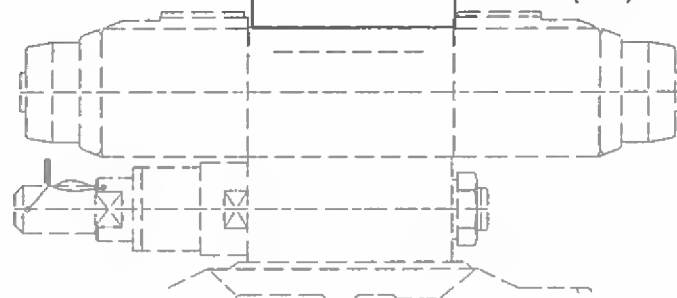
227,0 (8.9)

7-pin plug

Remove plug for  
access to the gain  
potentiometer

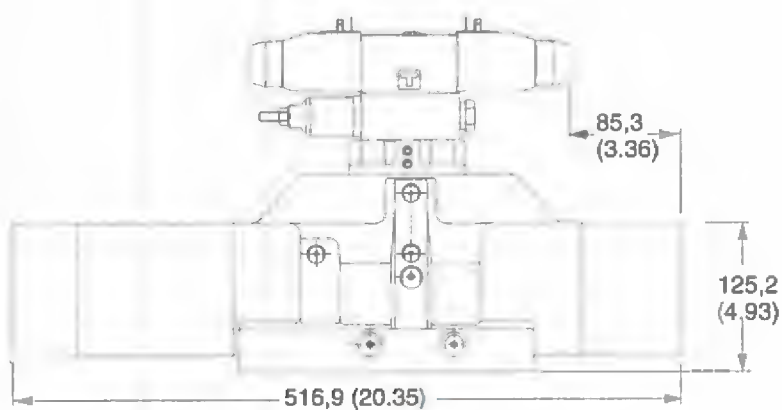
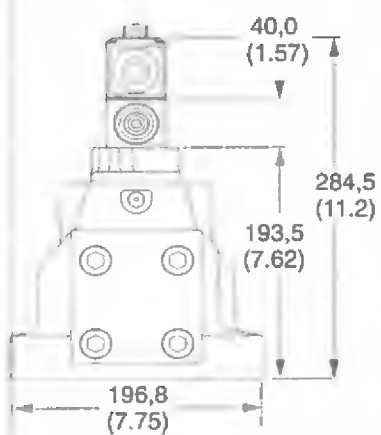
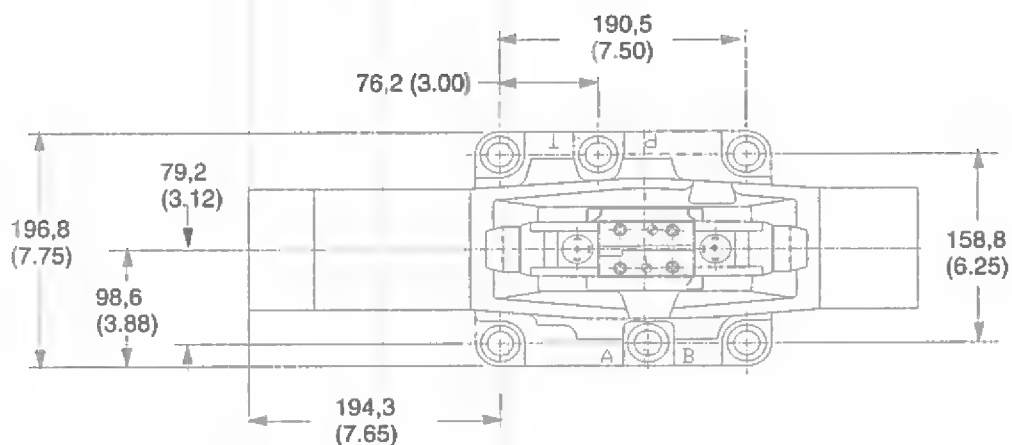
24,0  
(0.94)

128,0  
(5.1)



**KDG5V-10 Models with "EX" or "X"**  
 (With integral pilot pressure reducer)  
 Dimensions are shown in mm (inches)

3rd angle  
 projection



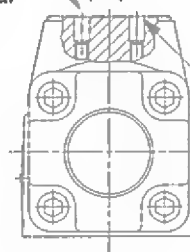
## Pilot Supply and Drain Plugs

### KDG5V-5 models

Viewed from port B end of main-stage

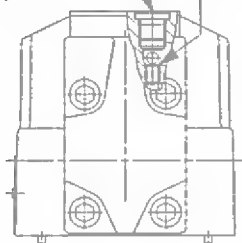
M5 plug,  
part no. 471119.  
Remove for internal  
pilot supply

Pilot  
connections  
P T

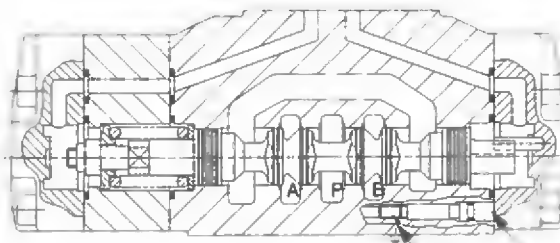


M5 plug,  
part no. 471119.  
Remove for internal pilot drain

**KDG5V-7  
models only\***  
Remove this plug  
for access to pilot  
drain plug



**KDG5V-7 models only\***  
M6 x 8mm plug, part no. 471131:  
fitted for external pilot drain.  
Not fitted for internal pilot drain.



**KDG5V-7 models only\***  
M6 x 8mm plug, part no. 471131:  
fitted for external pilot supply models; not fitted for  
internal pilot supply models. See "Model Code".

Size 7 only\*  
M5 internal thread for  
removal of closure plug

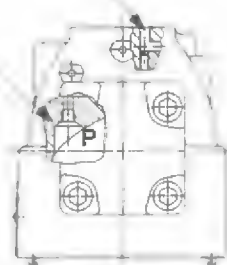
\* Internal plug shown, for external pilot supply (via port X).  
For internal pilot supply (from port P) plug is not fitted. Port X should be blocked at mounting interface, or otherwise plugged at subplate of manifold block. See "Model Code".

### KDG5V-8 models

Section through port P of main-stage

M5 plug,  
part no. 471119.  
Remove for internal pilot drain

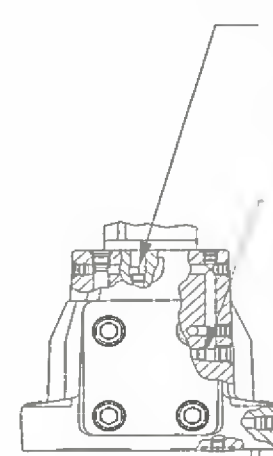
1/16" NPT plug,  
part no. 113000.  
Remove for internal  
pilot supply



### KDG5V-10 models

plug,  
part no. 7074.  
Remove for  
internal pilot  
drain

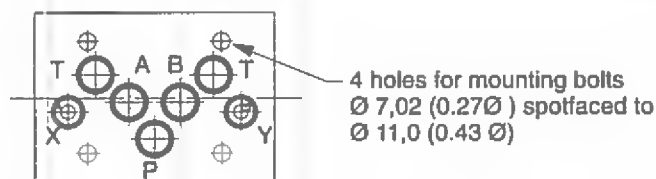
plug,  
part no. 30560 for  
internal pilot drain,  
part no. 7074 for  
external pilot drain.



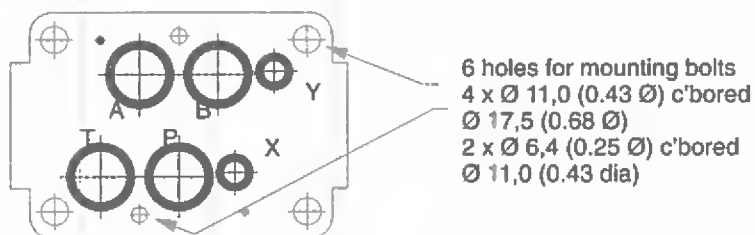
plug,  
part no. 30560. Remove for internal pilot drain

**Views on Mounting Faces**  
All O-seals supplied

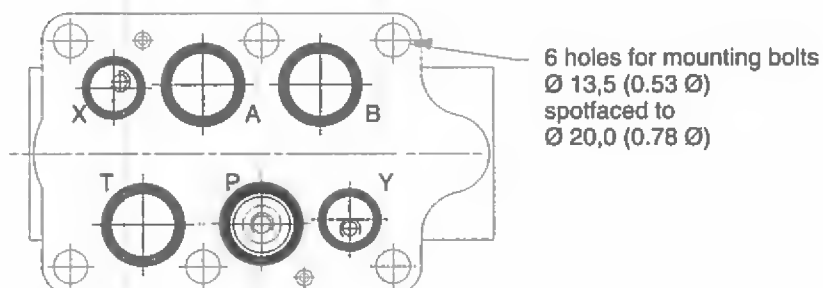
KDG5V-5 mounting face



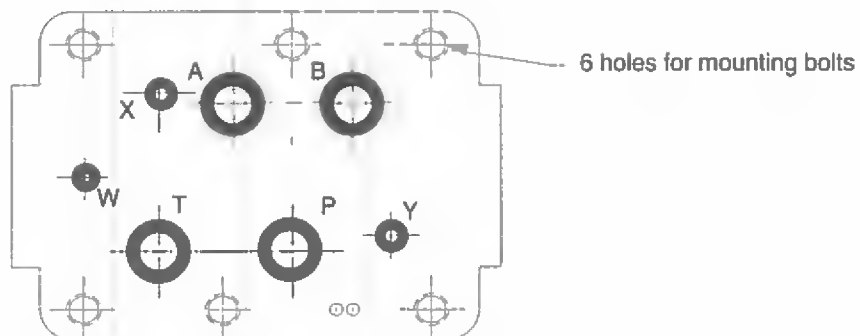
KDG5V-7 mounting face



KDG5V-8 mounting face



KDG5V-10 mounting face



# Subplates, Connection Plates and Mounting Surfaces

## Size 05

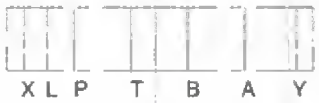
Description and Mass kg (lb)	Functional Symbol	Model Code	Max. Pressure
Blanking plate Cast iron 2,9 (6.4)		DGMA-5-B-1*	315 bar (4500 psi)
Crossover plate P-A; B-T Cast iron 2,9 (6.4)		DGMA-5-C1-1*	315 bar (4500 psi)
Crossover plate P-B; A-T Cast iron 2,9 (6.4)		DGMA-5-C2-1*	315 bar (4500 psi)
Tapping plate, ports A and B Cast iron 0,5 (1.1)		DGMA-5-T1-1*-B▲	315 bar (4500 psi)
Tapping plate, ports P and T Cast iron 0,5 (1.1)		DGMA-5-T2-1*-B▲	315 bar (4500 psi)
Tapping plate, ports P, A and B Cast iron 0,5 (1.1)		DGMA-5-T3-1*-B▲	315 bar (4500 psi)
Adaptor plate for pilot ports X and Y Cast iron 1,4 (3.1)		DGAM-5-1*-R▲ DGAM-5-1*-S▲	210 bar (3000 psi)
Single-station subplate; side ports P, T, A, B Cast iron 2,0 (4.4)		DGSME-01-2*-T8▲	210 bar (3000 psi)
Single-station subplate; rear ports P, T, A, B Cast iron 2,0 (4.4)		DGSM-01-2*-T8▲ EDGSM-01-1*-R▲ EDGSM-01X-1*-R▲ EDGSM-01Y-1*-R▲	210 bar (3000 psi) 280 bar (4000 psi)
Single-station subplate; rear ports P, T, A, B; and port L (side or rear) Cast iron 1,3 (2.9)		KDGSM-5-676805-2* (SAE/UNF ports)  KDGSME-5-615225-1* (1/2" BSPF ports) KDGSME-5-615226-1* (3/4" BSPF ports)	210 bar (3000 psi)  315 bar (4500 psi)
Single-station subplate; rear ports P, T, A, B plus X and Y Cast iron 2,0 (4.4)		EKDGSME-01Y-1*-R▲  EDGSM-03-1*-R▲ EDGSM-03X-1*-R▲ EDGSM-03X-1*-S▲	280 bar (4000 psi)  210 bar (3000 psi)

\*Design number subject to change. No change of installation dimensions for design numbers 10 to 19 or 21 to 29 inclusive.

▲ "S" or "T8" suffix = SAE/UNC ports and/or UNC fixing bolt tappings and/or orifice plugs as appropriate. "R" or "B" = ISO 228 (BSPF) ports and/or metric fixing bolt tappings and/or orifice plugs as appropriate.



Sizes 07 and 08

Description and Mass kg (lb)	Functional Symbol	Model Code	Max. Pressure
Single-station subplate		DGSM-04	210 bar (3000 psi)
Cast iron 3,8 (8.4)		EDGVM-7X	350 bar (5000 psi)
Cast iron 3,8 (8.4)		EDGVM-7Y/7Z	350 bar (5000 psi)
Cast iron 6,1 (13.4)		DGSM-8	210 bar (3000 psi)
Cast iron 5,0 (11)		EDGVM-8X	350 bar (5000 psi)
Cast iron 5,0 (11)		EDGVM-8Y/8Z	350 bar (5000 psi)
Cast iron 13 (28.6)			

General Description

When a subplate is not used, a machined pad must be provided for valve mounting. Pad must be flat within 0,127 mm (.0005 inch) and smooth within 1,6 µm (63 microinch). Mounting bolts, when provided by customer, should be SAE grade 7 or better.

Dimensional Tolerances

Dimensional tolerance on interface drawings is ±0.2 mm (±0.008") except where otherwise stated.

ISO 4401 specifies inch conversion to ±0.01".

Conversion from Metric

ISO 4401 gives dimensions in mm. Inch conversions are accurate to 0.01" unless otherwise stated.

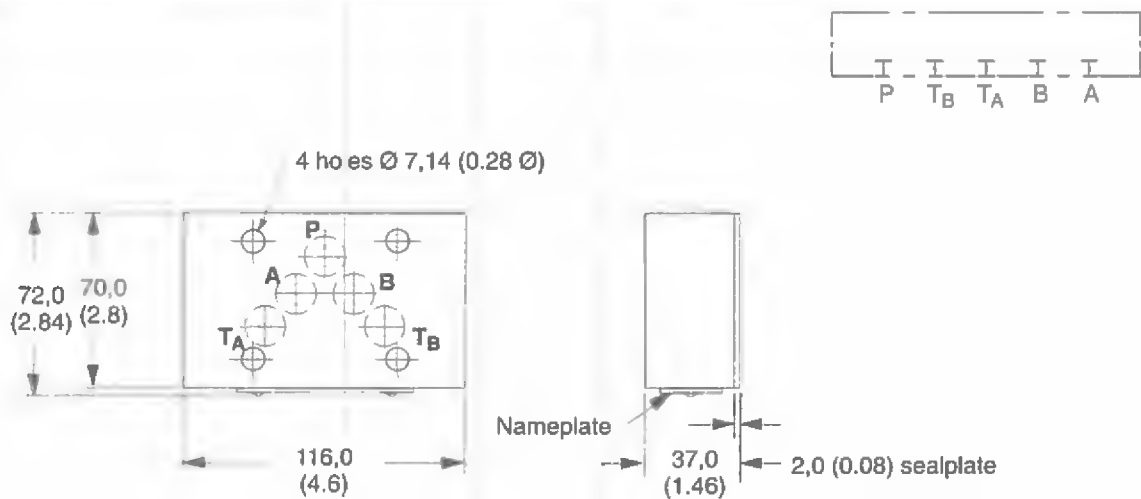
Mounting Bolt Tappings

ISO 4401 gives metric thread tappings. Alternate UNC tappings are Vickers

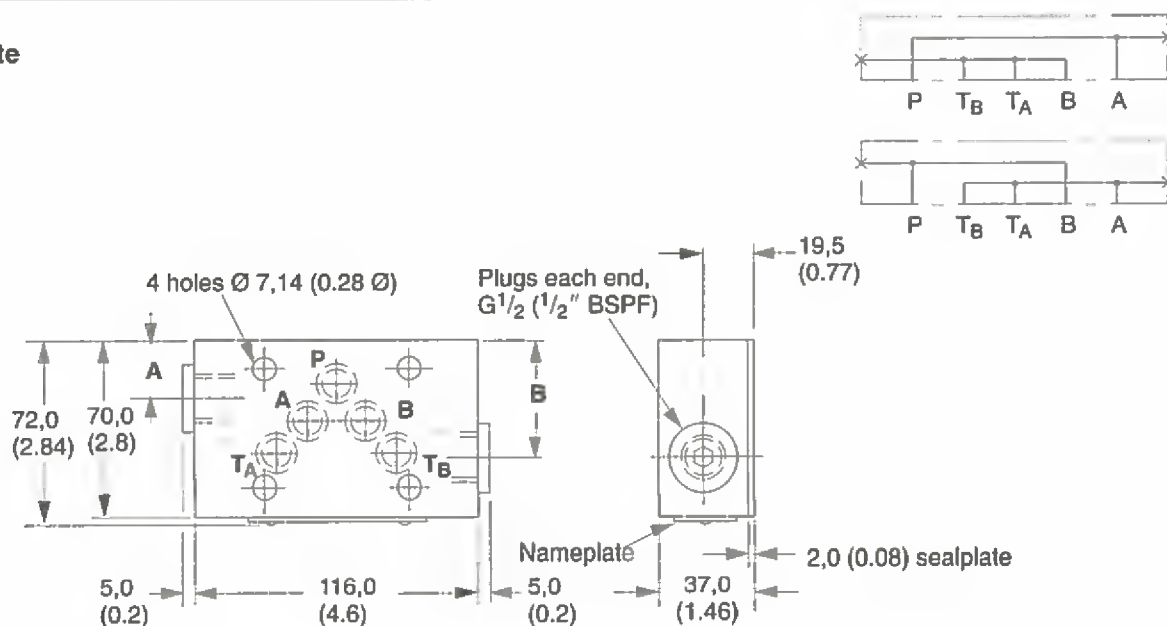
recommendations that allow these plates and associated valves to be used up to their maximum pressures, when using Vickers recommended bolt kits, or bolts of an equivalent strength (see page B.166). It is recommended that Customer's own manifold blocks for UNC bolts should be tapped to the minimum depths given in the footnotes.

Installation Dimensions

DGMA-5-B-1\*  
Blanking Plate

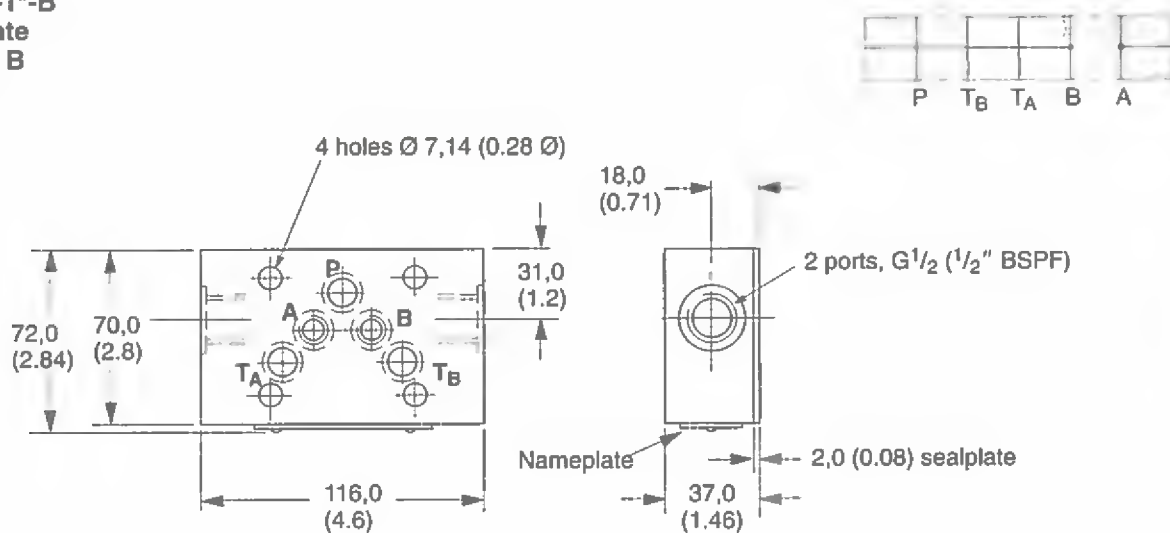


**DGMA-5-C\*-1\***  
Crossover Plate



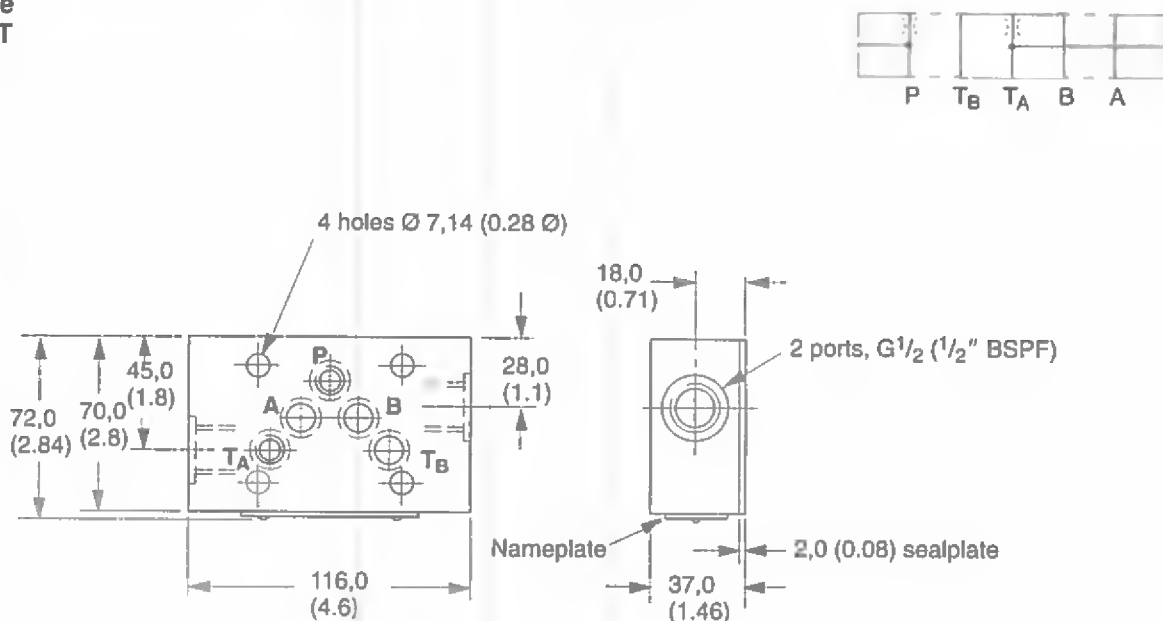
Model	Dimension A	Dimension B
DGMA-5-C1-1*	25,0 (1.0)	40,0 (1.6)
DGMA-5-C2-1*	40,0 (1.6)	25,0 (1.0)

**DGMA-5-T1-1\*-B**  
Tapping Plate  
Ports A and B



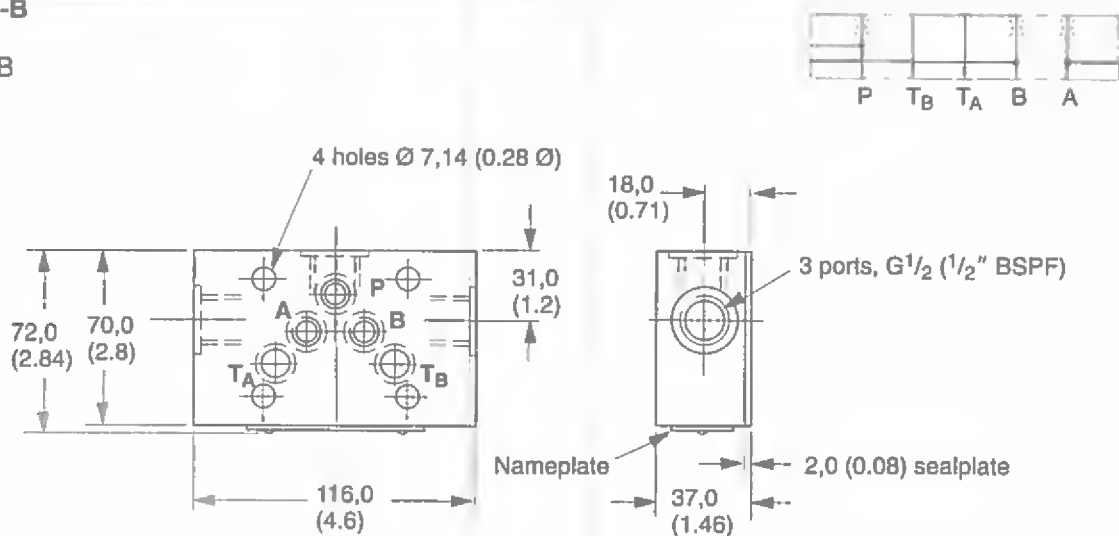
Ports A and B are tapped M12 x 14 (0.55) deep (e.g. for orifice plugs) on opposite face to sealplate.

**DGMA-5-T2-1\*-B**  
**Tapping Plate**  
**Ports P and T**



Ports P and T<sub>A</sub> are tapped M12 x 14 (0.55) deep (e.g. for orifice plugs) on opposite face to sealplate.

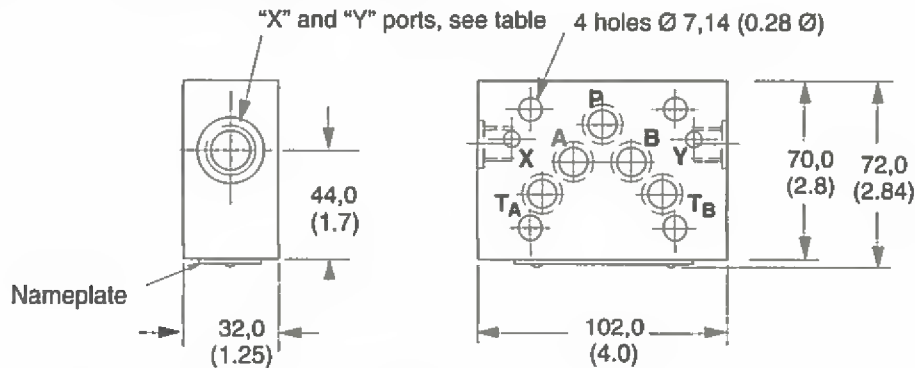
**DGMA-5-T3-1\*-B**  
**Tapping Plate**  
**Ports P, A and B**



Ports P, A and B are tapped M12 x 14 (0.55) deep (e.g. for orifice plugs) on opposite face to sealplate.

### DGAM-5-1\*-, X and Y Port Adaptor Plates

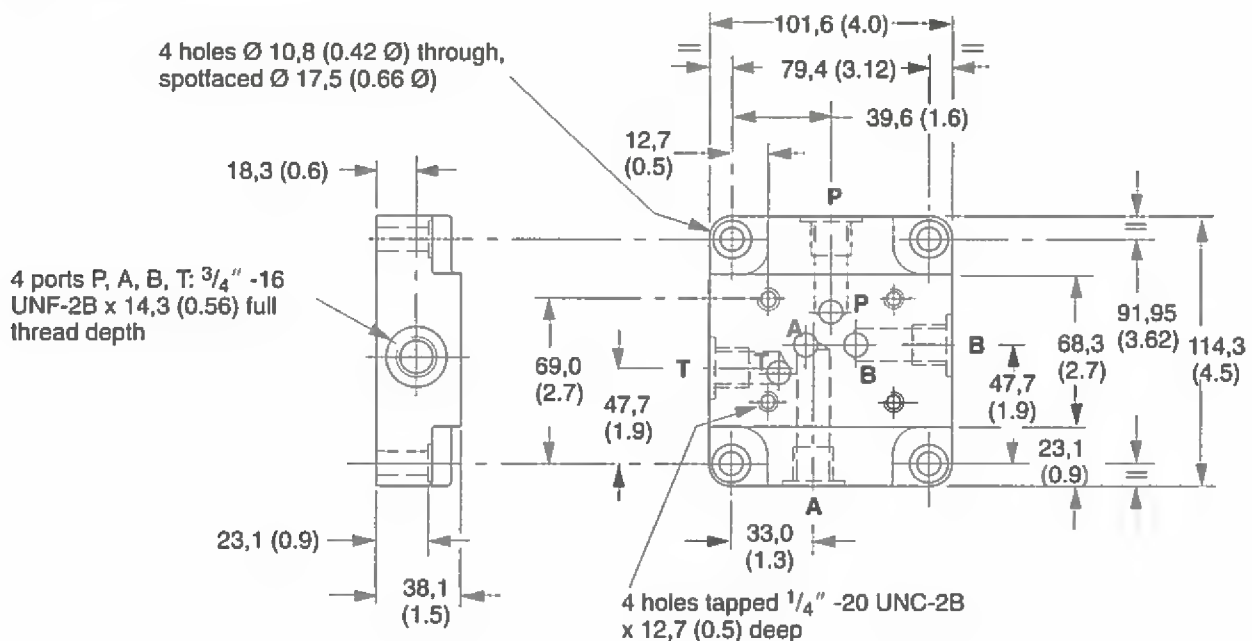
Provides for external connections to additional pilot ports X and Y when these ports are not present in subplate/manifold block. Typically used for two-stage directional and proportional valves.



Model	"X" and "Y" port thread
DGAM-5-1*-R	G1/4 (1/4" BSPF x 11,0 (0.43) full thread depth
DGAM-5-1*-S	9/16"-18UNF x 12,7 (0.5) full thread depth

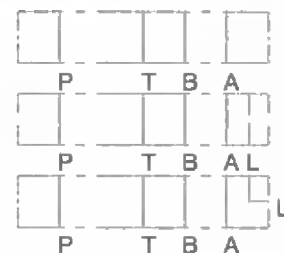
### DGSME-01-2\*-T8

Subplate with Side Ports P, T, A, B  
Maximum Pressure 210 bar (3000 psi)



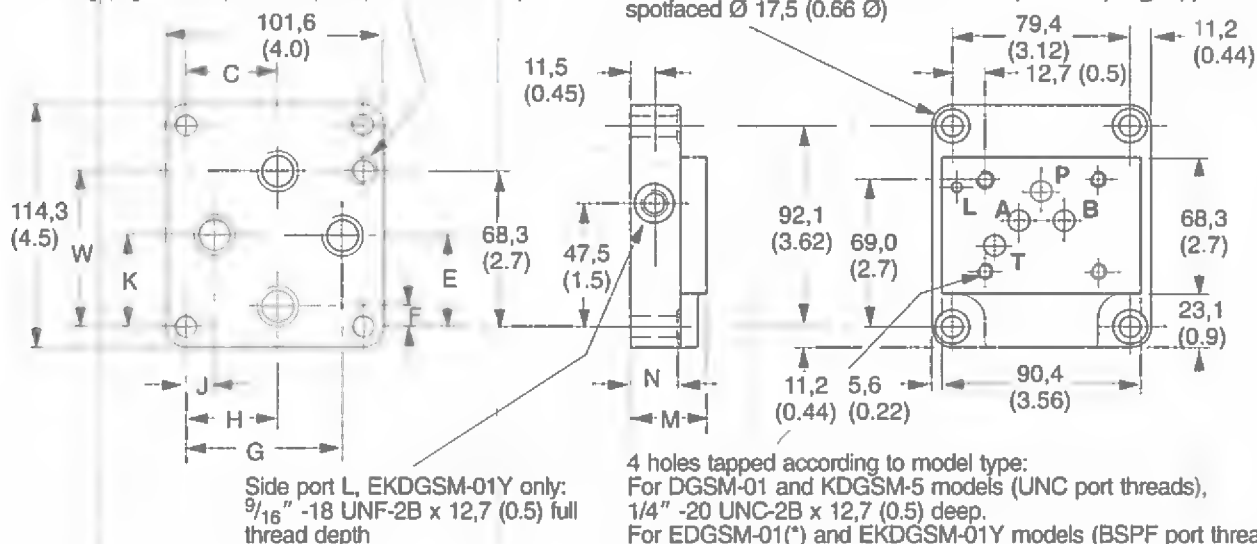
**DGSM-01-2\*-T8**  
**KDGSM-5-676805-2\***  
 (with rear port L)  
 Subplates with Rear Ports P, T, A, B  
 Maximum Pressure 210 bar (3000 psi)

**EDGSM-01-1\*-R**  
**EDGSM-01X-1\*-R**  
**EDGSM-01Y-1\*-R**  
**EKGSM-01Y-1\*-R**  
 (with side port L)  
 Maximum Pressure 280 bar (4000 psi)



Rear port L, KDGM-5-676805 only:  
 G<sup>1</sup>/<sub>8</sub>" (1/8" BSPF) x 12,0 (0.47) full thread depth

4 holes Ø 10,8 (0.42 Ø) through,  
 spotfaced Ø 17,5 (0.66 Ø)



Side port L, EKGSM-01Y only:  
 9/16" -18 UNF-2B x 12,7 (0.5) full thread depth

4 holes tapped according to model type:  
 For DGSM-01 and KDGM-5 models (UNC port threads),  
 1/4" -20 UNC-2B x 12,7 (0.5) deep.  
 For EDGSM-01(\*) and EKGSM-01Y models (BSPF port threads),  
 M6-6H x 15,8 (0.62) deep.

#### Ports P, T, A, B Threads

Model	Port thread
210 bar (3000 psi) DGSM-01-2*-T8 KDGM-5-676805-2*	3/4" -16 UNF-2B x 14,0 (0.56) full thread depth

#### Ports P, T, A, B Threads

Model	Port thread
280 bar (4000 psi) EDGSM-01-1*-R	G1/4 (1/4" BSPF) x 12,2 (0.48) full thread depth
EDGSM-01X-1*-R	G3/8 (3/8" BSPF) x 12,2 (0.48) full thread depth
EDGSM-01Y-1*-R EKGSM-01Y-1*-R	G1/2 (1/2" BSPF) x 15,0 (0.59) full thread depth

Model	C	E	F	G	H	J	K	M	N	W
210 bar (3000 psi) DGSM-01-2*-T8 KDGM-5-676805-2*	45,2 (1.78)	42,1 (1.7)	19,0 (0.75)	68,3 (2.69)	45,2 (1.78)	23,8 (0.94)	42,1 (1.7)	31,8 (1.25)	23,9 (0.94)	57,1 (2.25)
280 bar (4000 psi) EDGSM-01-1*-R	39,7 (1.56)	38,1 (1.5)	13,5 (0.53)	65,5 (2.58)	41,7 (1.64)	10,3 (0.41)	40,9 (1.61)	31,8 (1.25)	23,9 (0.94)	62,7 (2.47)
EDGSM-01X-1*-R	39,7 (1.56)	40,5 (1.59)	13,5 (0.53)	67,5 (2.66)	39,7 (1.56)	12,7 (0.5)	40,5 (1.59)	31,8 (1.25)	23,9 (0.94)	68,6 (2.7)
EDGSM-01Y-1*-R	39,7 (1.56)	40,5 (1.59)	9,9 (0.39)	70,6 (2.78)	39,7 (1.56)	10,7 (0.42)	40,5 (1.59)	31,8 (1.25)	28,6 (1.13)	72,6 (2.86)
EKGSM-01Y-1*-R	39,7 (1.56)	40,5 (1.59)	9,9 (0.39)	70,6 (2.78)	39,7 (1.56)	10,7 (0.42)	40,5 (1.59)	36,5 (1.44)	28,6 (1.13)	72,6 (2.86)

**KDGSM-5-615225-1\*****KDGSM-5-615226-1**

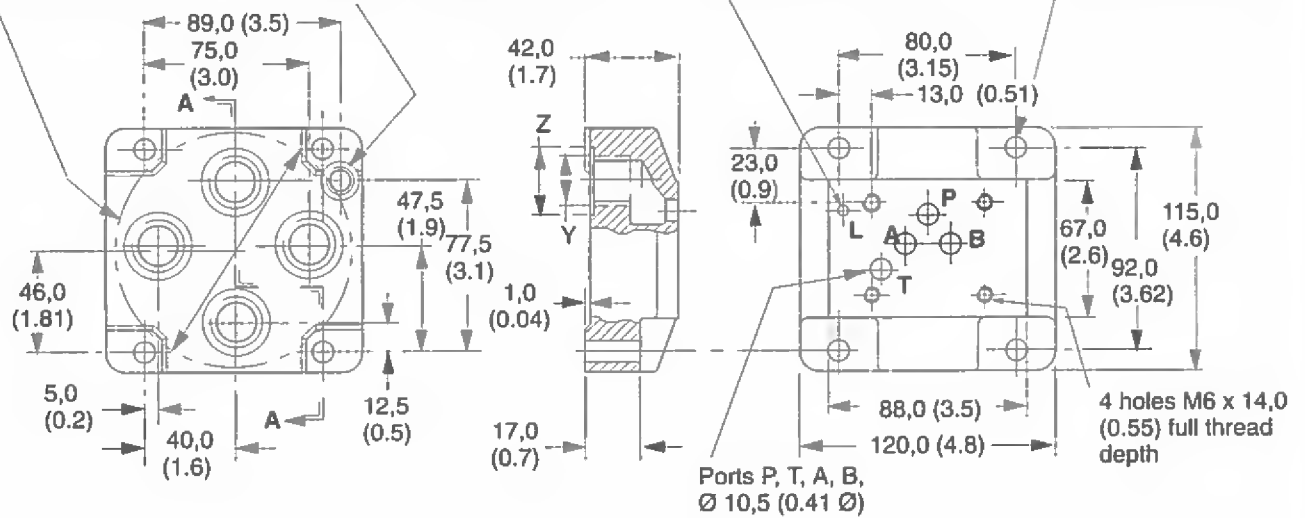
Subplates with Rear Ports P, T, A, B, L

Maximum Pressure 315 bar (4500 psi)

Recommended panel  
cut-out to clear fittings,  
Ø 108,0 (4.25 Ø)Port L, G<sup>1</sup>/<sub>4</sub> (1/4" BSPF) x 12,0 (0.47),  
spotfaced to Ø 24,0 (0.94 Ø)

Port L, Ø 4,0 (0.16 Ø)

4 holes Ø 10,5 (0.41 Ø)



Part Section A-A

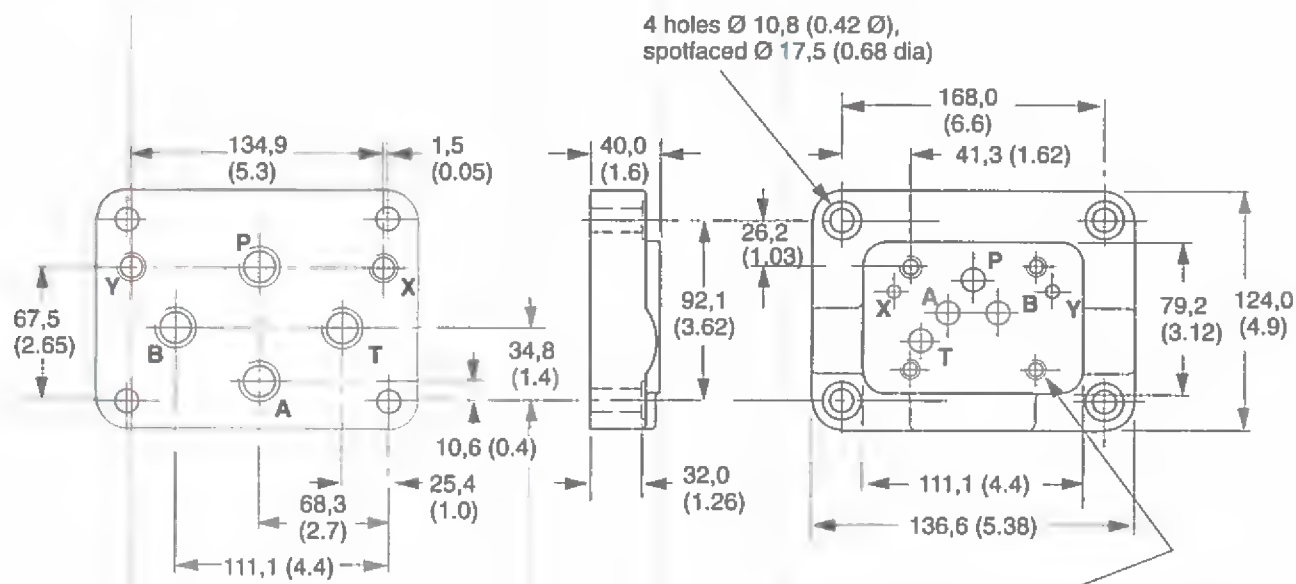
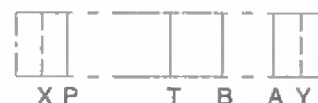
**Ports P, T, A, B**

Model	Y thread	Z diameter
KDGSM-5-615225-1*	G <sup>1</sup> / <sub>2</sub> (1/2" BSPF) x 14,0 (0.55) full thread depth	30,0 (1.18)
KDGSM-5-615226-1*	G <sup>3</sup> / <sub>4</sub> (3/4" BSPF) x 16,0 (0.63) full thread depth	33,0 (1.3)



**EDGSM-03-1\*-R**  
**EDGSM-03X-1\*-R**  
**EDGSM-03X-1\*-S**

Subplates with Rear Ports P, T, A, B, X, Y  
 Maximum Pressure 210 bar (3000 psi)



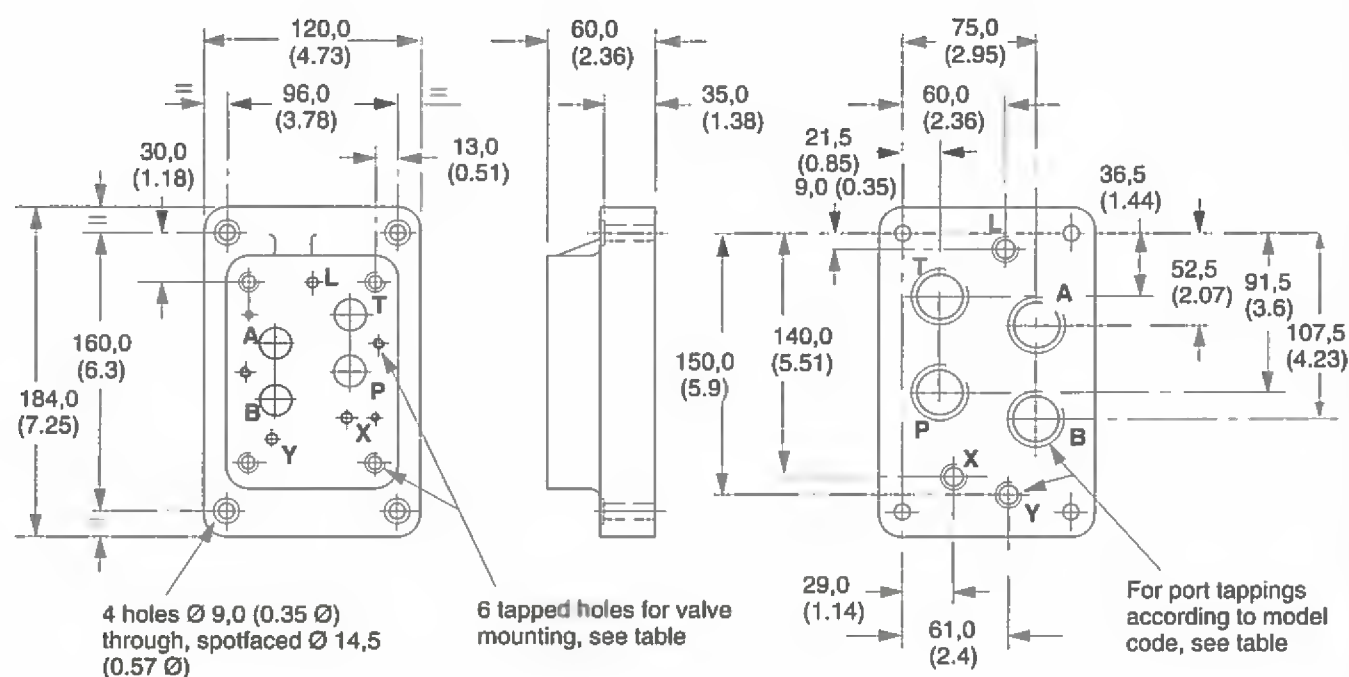
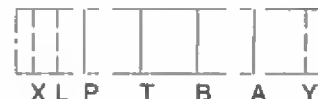
4 holes tapped according to model type:  
 For EDGSM-03(X)-1\*-R models (BSPF ports):  
 M6-6H x 16,0 (0.63) full thread depth  
 For EDGSM-03X-1\*-S models (UNC ports):  
 1/4"-20 UNC-2B x 16,0 (0.63) full thread depth

**Port Threads**

Model	Ports P, T, A, B	Ports X, Y
EDGSM-03-1*-R EDGSM-03X-1*-R	G <sup>1</sup> / <sub>2</sub> (1/2" BSPF) x 14,0 (0.55) full thread depth	G <sup>1</sup> / <sub>4</sub> (1/4" BSPF) x 12,2 (0.48) full thread depth
EDGSM-03X-1*-S	1 1/16"-12 UN-2B x 16,0 (0.63) full thread depth	9/16"-18 UNF-2B x 12,7 (0.5) full thread depth

**EDGVM-7Y-D-1\*-R** (BSPF port threads; metric mounting bolts)  
**EDGVM-7Z-D-1\*-S** (UNF/SAE port threads; UNC mounting bolts)  
**Single station subplates**

**For up to 350 bar (5000 psi) Maximum Pressure**  
Dimensions in mm (inches)

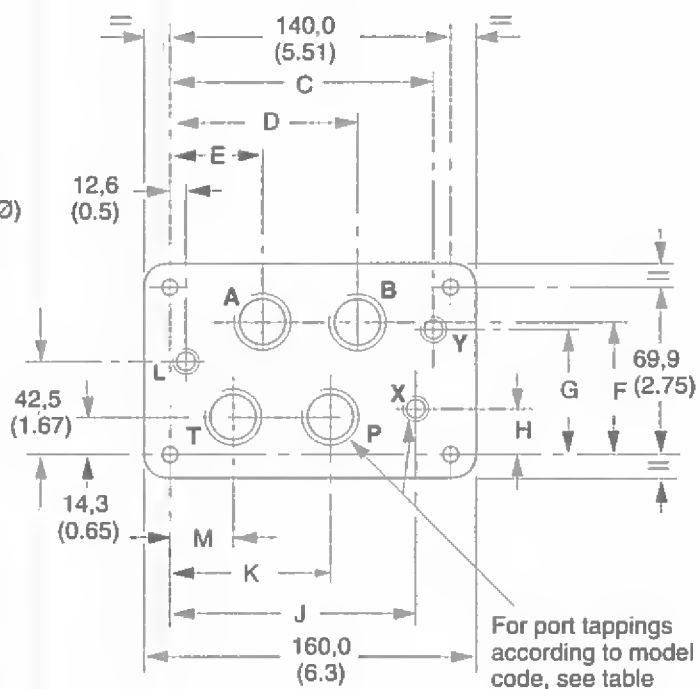
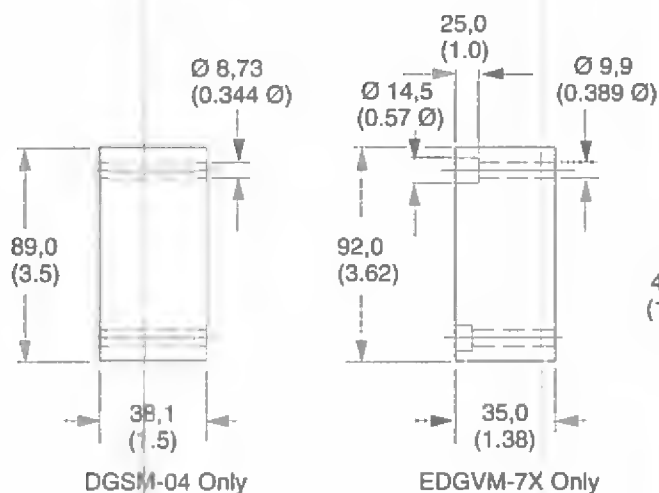


**Port and Bolt Threads**

Model	Ports P, T, A, B	Ports L, X, Y	Mounting bolt tapping
EDGVM-7Y-D-1*-R	G1 (1" BSPF) x 19,0 (0.75) full thread depth	G1/4 (1/4" BSPF) x 12,0 (0.47) full thread depth	4 x M10 2 x M6
EDGVM-7Z-D-1*-S	1 15/16" -12 UN 2B x 19,0 (0.75) full thread depth	3/16" -18 UNF 2B x 12,7 (0.5) full thread depth	4 x 3/8"-16 UNC 2 x 1/4"-20 UNC

**DGSM-04-12S-2\*** (UNF/SAE port threads; UNC mounting bolts)  
For up to 210 bar (3000 psi) Maximum Pressure

**EDGVM-7X-D-1\*-R** (BSPF port threads; metric mounting bolts)  
For up to 350 bar (5000 psi) Maximum Pressure  
Single station subplates



#### Port and Bolt Threads

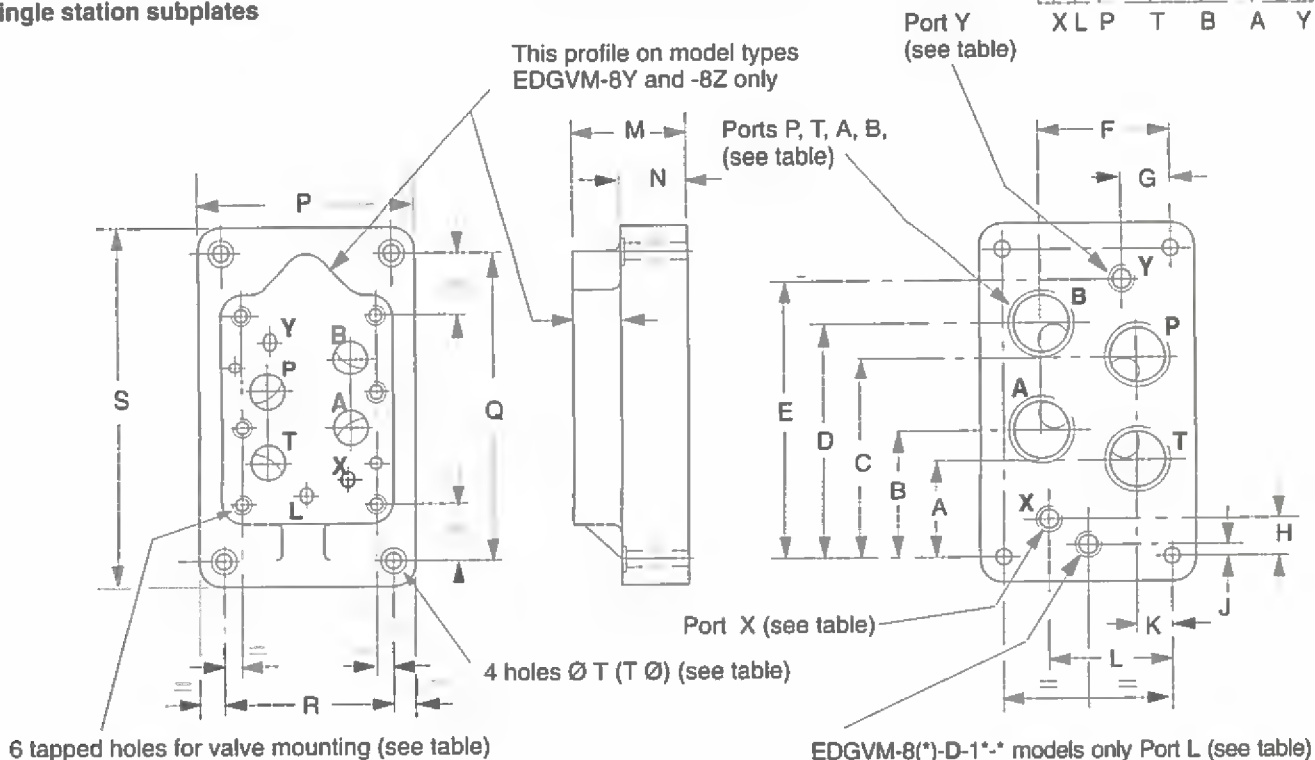
Model	Ports P, T, A, B	Ports L, X, Y	Mounting bolt tapping
DGSM-04-12S-2*	1 1/16"-12 UNF-2B x 19,1 (0.75) full thread depth	9/16"-18 UNF-2B x 12,7 (0.5) full thread depth	4 x 3/8"-16 UNC 2 x 1/4"-20 UNC
EDGVM-7X-D-1*-R	G3/4 (3/4" BSPF) x 16,0 (0.63) full thread depth	G1/4 (1/4" BSPF) x 12,0 (0.47) full thread depth	4 x M10 2 x M6

#### Dimensions

Model	C	D	E	F	G	H	J	K	M
DGSM-04-12S-2*	121,4 (4.78)	88,4 (3.48)	44,2 (1.74)	56,6 (2.23)	54,9 (2.16)	18,3 (0.72)	121,4 (4.78)	76,7 (3.02)	32,3 (1.27)
EDGVM-7X-D-1*-R	128,6 (5.06)	93,6 (3.68)	50,6 (1.99)	55,6 (2.19)	52,0 (2.05)	15,9 (0.63)	113,6 (4.47)	79,6 (3.13)	36,6 (1.44)

**EDGVM-8(\*)-1\*-R** (BSPF port threads;  
metric mounting bolts)  
**EDGVM-8Y-1\*-S** (UNF/SAE port threads;  
UNC mounting bolts)  
For up to 350 bar (5000 psi) Maximum Pressure  
Ports P, T, A, B, X, Y  
Single station subplates

**EDGVM-8(\*)-D-1\*-R** (BSPF port threads;  
metric mounting bolts)  
**EDGVM-8Y-D-1\*-S** (UNF/SAE port threads;  
UNC mounting bolts)  
Ports P, T, A, B, X, Y and L  
Single station subplates



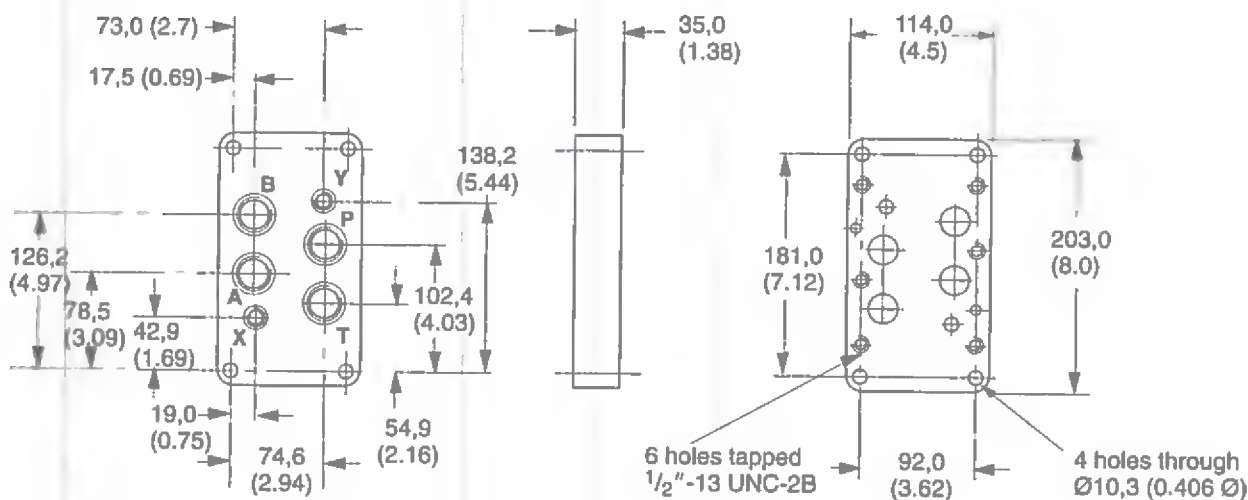
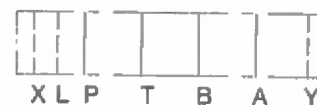
**Port Threads, Bolt Tappings and Dimensions**

Model	Ports P, A, B, T	Ports L, X, Y	Mounting bolt tappings	A	B	C	D	E	F
EDGVM-8(-D)-1*-R	G <sup>3</sup> / <sub>4</sub> x 16 (0.63) deep (BSPF)	G <sup>1</sup> / <sub>4</sub> x 12,2 (0.48) deep (BSPF)	M12 x 25 (1.0) deep	54,8 (2.16)	78,6 (3.09)	102,4 (4.03)	126,2 (4.97)	160 (6.30)	74,6 (2.94)
EDGVM-8X(-D)-1*-R	G1 x 19 (0.74) deep (BSPF)	G <sup>1</sup> / <sub>4</sub> x12,2 (0.48) deep (BSPF)	M12 x 25 (1.0) deep	49,6 (1.95)	73,4 (2.89)	107,5 (4.23)	131,4 (5.17)	160 (6.30)	74,6 (2.94)
EDGVM-8Y(-D)-1*-R	G1 <sup>1</sup> / <sub>4</sub> x 21 (0.82) deep (BSPF)	G <sup>1</sup> / <sub>4</sub> x12,2 (0.48) deep (BSPF)	M12 x 25 (1.0) deep	50,5 (1.99)	74,2 (2.92)	128,0 (5.04)	151,8 (5.98)	185 (7.28)	103 (4.06)
EDGVM-8Y(-D)-1*-S	1 <sup>5</sup> / <sub>8</sub> "-12 UN x 19,1 (0.75) deep	9/ <sub>16</sub> "-18 UNF x 12,7 (0.5) deep	1 <sup>1</sup> / <sub>2</sub> "-13 UNC-2B	50,5 (1.99)	74,2 (2.92)	128,0 (5.04)	151,8 (5.98)	185 (7.28)	103 (4.06)
EDGVM-8Z(-D)-1*-R	G1 <sup>1</sup> / <sub>2</sub> x 22 (0.86) deep (BSPF)	G <sup>1</sup> / <sub>4</sub> x12,2 (0.48) deep (BSPF)	M12 x 25 (1.0) deep	50,5 (1.99)	74,2 (2.92)	128,0 (5.04)	151,8 (5.98)	185 (7.28)	103 (4.06)

Model	G	H	J	K	L	M	N	P	Q	R	S	ØT
EDGVM-8(-D)-1*-R	19	21	31	17,4	73	—	35	119	181	92,1	204	10,8
EDGVM-8X(-D)-1*-R	(0.75)	(0.83)	(1.22)	(0.685)	(2.87)	—	(1.38)	(4.69)	(7.13)	(3.63)	(8.03)	(0.425)
EDGVM-8Y(-D)-1*-R	33	17,5	5,6	27	97	72	45	160	202	130	232	13,5
EDGVM-8Y(-D)-1*-S	(1.30)	(0.69)	(0.22)	(1.06)	(3.82)	(2.84)	(1.77)	(6.30)	(7.95)	(5.12)	(9.13)	(0.53)
EDGVM-8Z(-D)-1*-R												

**DGSM-8-1\*-T\*\* (UNF/SAE ports; UNC mounting bolts)**  
**For up to 210 bar (3000 psi) Maximum Pressure**  
**Ports P, T, A, B, X, Y**  
**Single station subplates**



#### Port Threads

Model	Ports P, T, A, B	Ports X, Y
DGSM-8-1*-T12	1 1/16"-12 UN x 19,1 (0.75) deep	9/16"-18 UNF x 12,7 (0.5) deep
DGSM-8-1*-T16	1 5/16"-12 UN x 19,1 (0.75) deep	9/16"-18 UNF x 12,7 (0.5) deep

## Mounting Surface

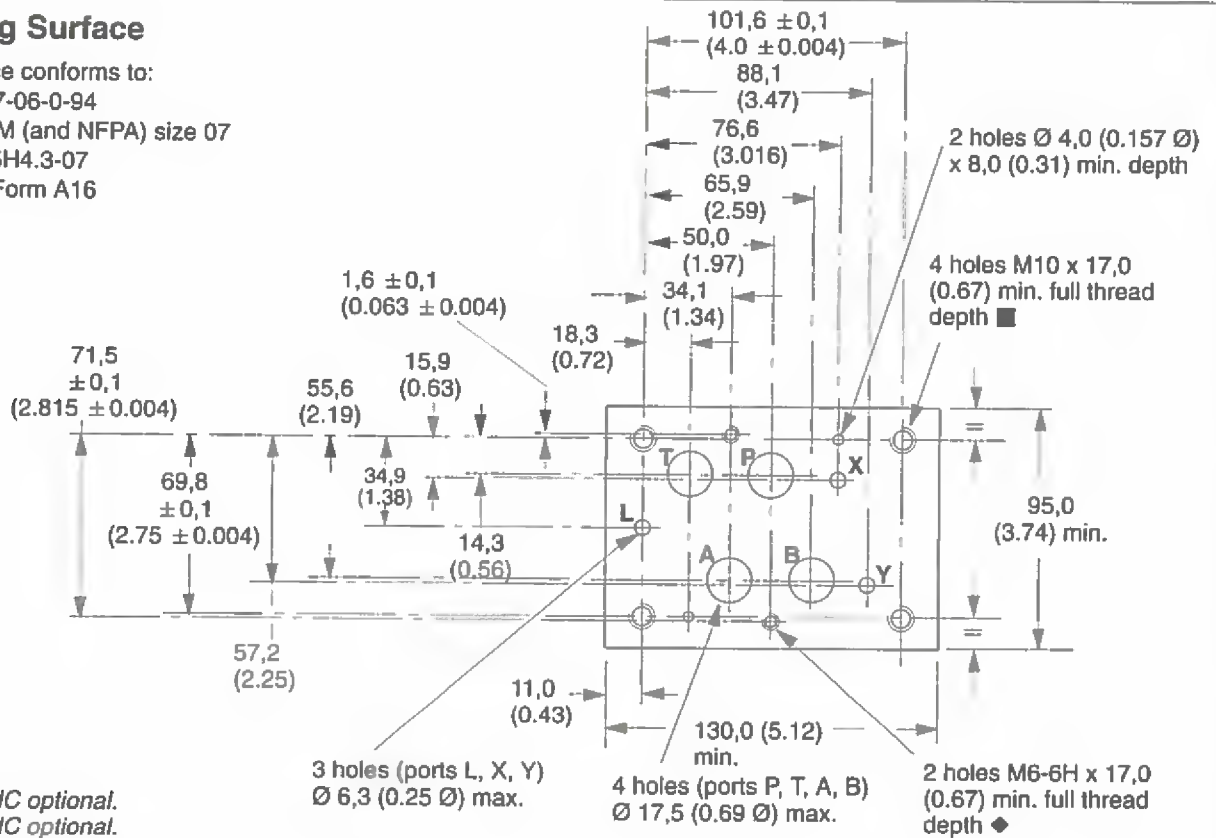
This interface conforms to:

ISO 4401-07-06-0-94

ANSI/B93.7M (and NFPA) size 07

CETOP R35H4.3-07

DIN 24340 Form A16



■  $\frac{3}{8}$ "-16 UNC optional.

◆  $\frac{1}{4}$ "-20 UNC optional.

## Mounting Surface

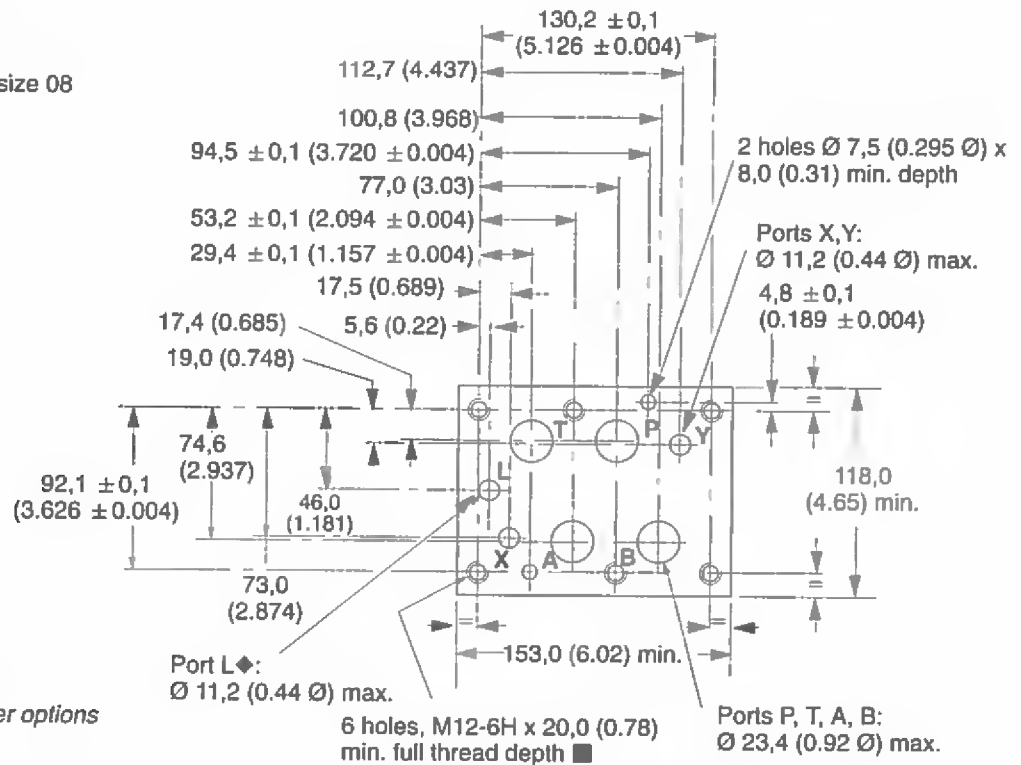
This interface conforms to:

ISO 4401-08-07-0-94

ANSI/B93.7M (and NFPA) size 08

CETOP R35H4.3-08

DIN 24340 Form A25



■  $\frac{1}{2}$ "-13 UNC optional.

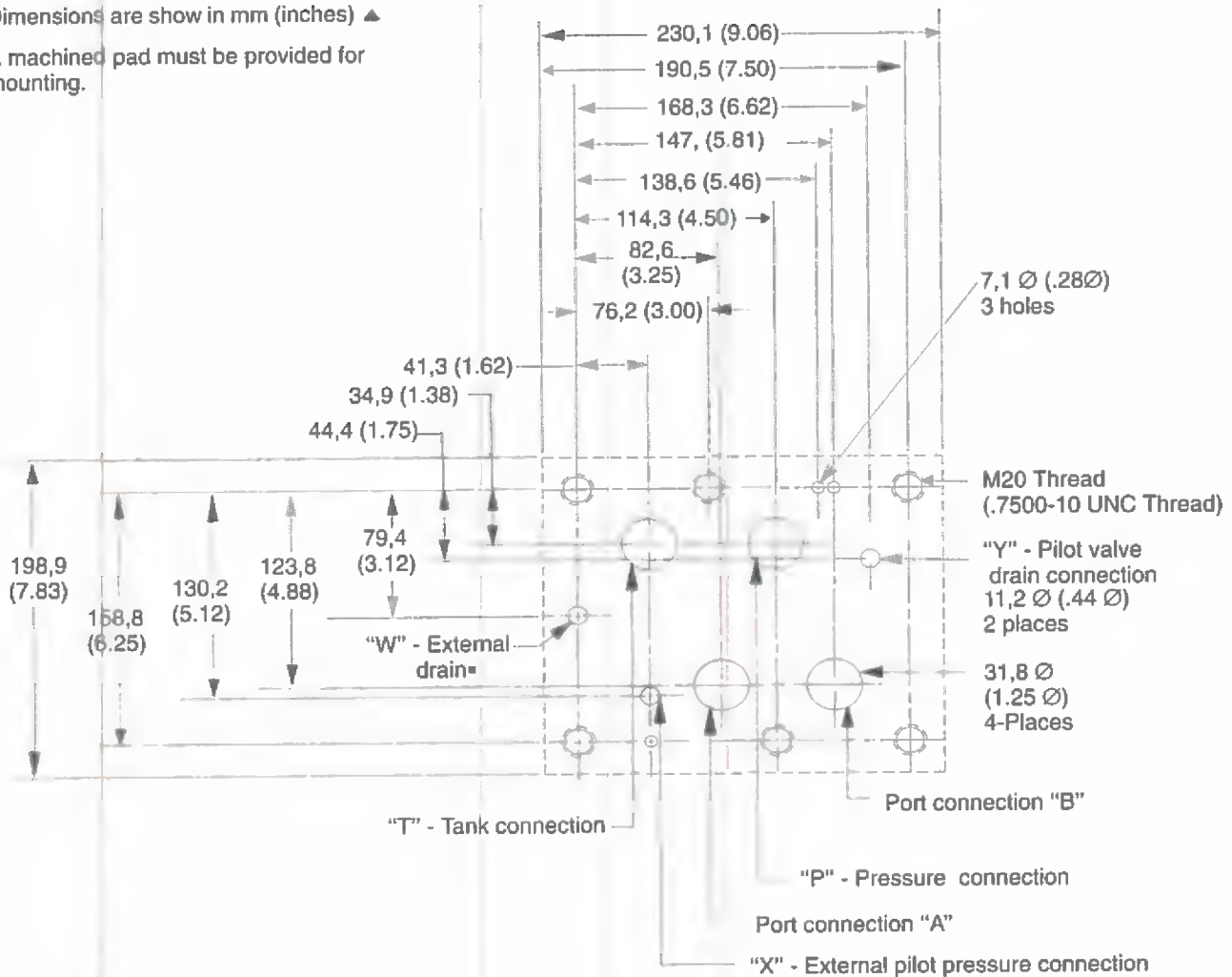
◆ Vickers uses port L for pressure-centered and other options not in high demand.



## Mounting Surface

Dimensions are shown in mm (inches) ▲

A machined pad must be provided for mounting.



■ Required for 'D' Pressure Centered models only

### Mounting Bolt Tapping Options

ISO/DIS 4401-02-02 defines only M5 tapping. Inch tapping options are as available in Vickers subplates and manifolds.

▲ ISO 4401 gives dimensions in mm. Inch conversions are accurate to 0.01" unless stated.

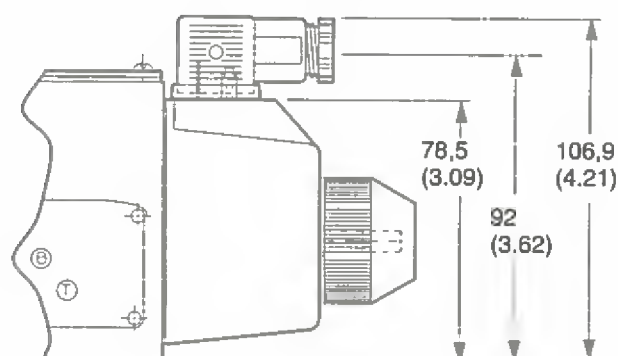
▼ It is recommended that customers' own manifold blocks for UNC bolts be tapped to these minimum depths.

Thread	Min. tapping depth for subplates/manifolds in:		
	Steel	Cast Iron	Aluminum
Metric M5-6H	12,3 (0.484)	12,3 (0.484)	12,3 (0.484)
Inch #10-24 UNC-2B	12,6 (0.496)▼	14,9 (0.587)▼	14,9 (0.587)▼

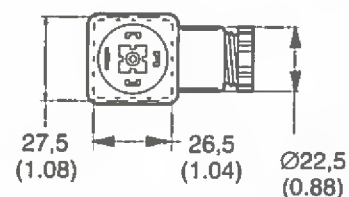
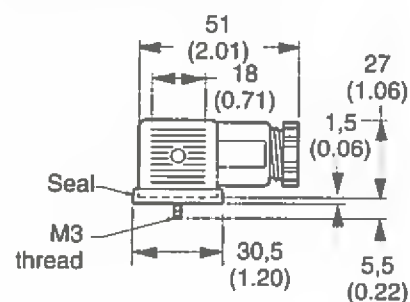
# Electrical Information

## Plug connector (Order separately) (ISO4400/DIN 43650)

Cable diameter range ... Ø6–10 mm (0.24–0.40)  
 Wire section range ..... Ø,5–1,5 mm<sup>2</sup> (0.0008–0.0023 in<sup>2</sup>)  
 Terminals ..... Screw type  
 Type of protection ..... IEC144 class IP65, when plugs are fitted correctly to the valves with the interface seals (supplied with plugs) in place.



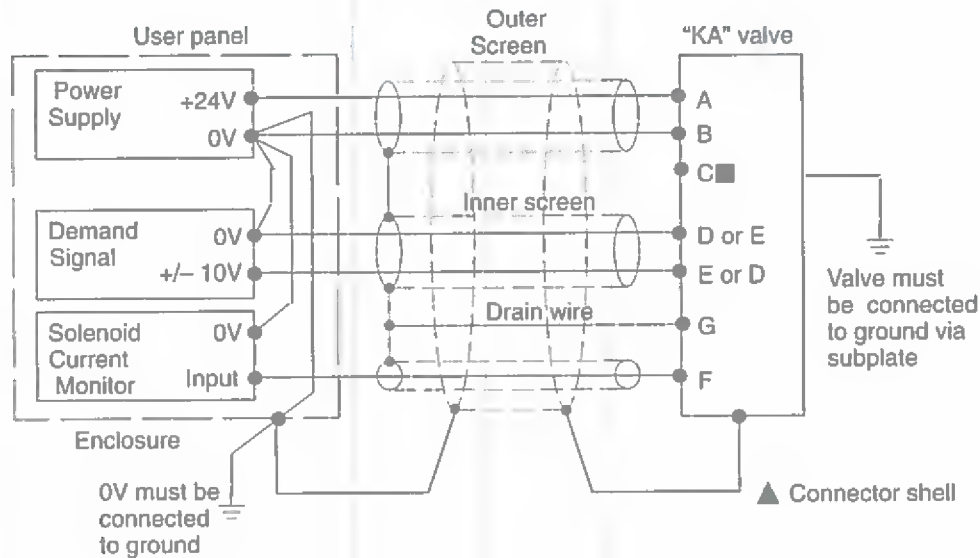
Connector can be positioned at 90° intervals on valve by re-assembling contact holder into appropriate position inside connector housing. Connectors with and without indicator lights are available (order separately).



Receptacle	Voltage (AC or DC)	Gray "A" sol.	Black "B" sol.
Without lights	—	710776	710775
With lights	12-24	977467	977466
	100-125	977469	977468
	200-240	977471	977470

# Typical Connection Arrangements

KADG5V-5/7/8, valves with integral amplifier



■ Solenoid current monitor voltage (pin F) will be referenced to the KA valve local ground. A "local ground" (pin C) is provided for optional use by differential input customer supplied electronics.

▲ Note: In applications where the valve must conform to European RFI/EMC regulations, the outer screen (shield) must be connected to the outer shell of the 7-pin connector and the valve body must be fastened to the earth ground. Proper earth grounding practices must be observed in this case, as any differences in command source and valve ground potentials will result in a screen (shield) ground loop.



## Warning

Do not ground pin C. If the local ground (pin C) is not used for differential monitor electronics, do not use. Read monitor pin F with respect to ground.



## Warning

Electromagnetic Compatibility (EMC)

It is necessary to ensure that the valve is wired-up as above. For effective protection, the user electrical cabinet, the valve subplate or manifold, and the cable screens should be connected to efficient ground points. The metal 7-point connector, part no. 934939, should be used for the integral amplifier.

In all cases, both valve and cable should be kept as far as possible from any sources of electromagnetic radiation such as cables carrying heavy current, relays and certain kinds of portable radio transmitters, etc. Difficult environments could mean that extra screening may be necessary to avoid the interference.

It is important to connect the 0V lines as shown above. The multi-core cable should have at least two screens to separate the demand signal and monitor output from the power lines.

# Electrical Block Diagram

## KADG5V5-5/7/8, valves with integral amplifier

### Wiring

Connections must be made via the 7-pin plug mounted on the amplifier.

Recommended cable sizes are:

#### Power cables:

For 24V supply

0,75 mm<sup>2</sup> (18 AWG) up to 20m (65 ft)

1,00 mm<sup>2</sup> (17 AWG) up to 40m (130 ft)

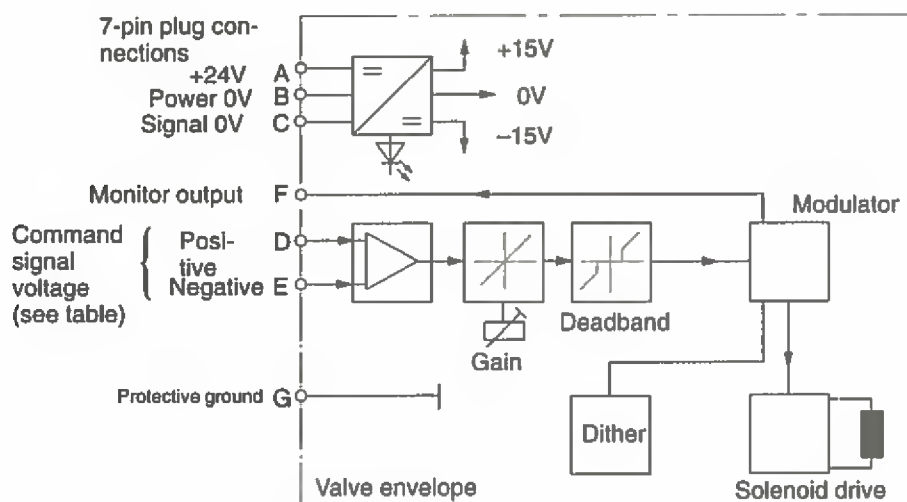
#### Signal cables:

0,50 mm<sup>2</sup> (20 AWG)

#### Screen:

A suitable cable would have 7 cores, a separate screen for the signal wires and an overall screen.

See wiring connection diagram on previous page.



### Warning

All power must be switched off before connecting or disconnecting any plugs.

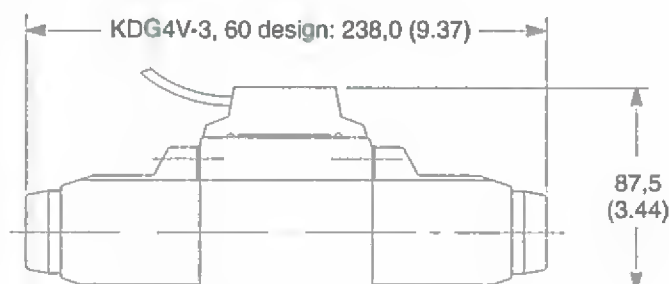
## Single-Cable UNIPLUG Connector EHH-AMP-724 D \*\* - 1\*

Vickers UNIPLUG is a single-cable electrical connector ideally suited for economical wiring of single and double-solenoid models. It is introduced on the well-established size 3 proportional valves, KDG4V-3(S), 60 series, respectively. The UNIPLUG connector is released in four 24V versions, offering:

- Control of proportional valves from low voltage differential input signal
- Direct switching of 24V DC solenoids

The UNIPLUG connector is supplied loose for customer assembly to valves, which must be fitted with type "P" plug-in coils.

The correctly installed UNIPLUG/ valve combination conforms to protection code IEC 529 class IP67.




Double solenoid models

## Operating Data

Cable:	
wire size	1 mm <sup>2</sup> (18 AWG)
cable sheathing	Polyurethane
cable screening	Types C and D only
Ambient temperature range:	
operating	-20 to +70°C (-4 to +158°F)
storage	-25 to +70°C (-13 to +158°F)
Electro-magnetic compatibility (EMC)	
emission	EN50081-2
immunity	EN50082-2
Protection class	IEC 529, IP67 when correctly assembled and installed on a designated valve type
Housing material	Ultradid A3 HG3



This product has been designed and tested to meet specific standards outlined in the European Electromagnetic Compatibility Directive (EMC) 89/336/EEC, amended by 91/263/EEC. For instructions on installation requirements to achieve effective protection levels, see this leaflet and the Installation Wiring Practices for Vickers Electronic Products leaflet 2468. Wiring practices relative to this directive are indicated by  European Electromagnetic Compatibility (EMC)

### Electrical Data, Type D

Plug with proportional amplifiers with independent adjustable gain and deadband for each of two solenoid outputs, plus a common adjustable ramp.

LEDs show status of output.

Connections (coded to DIN VDE 0293): wire no. 1 wire no. 2 wire no. 3 wire no. 4 screen	Positive command signal Negative command signal 0V (power and signal) 24V power supply Connect to a suitable ground point
Power supply (to VDE 0160) Max. permissible voltage	24V DC (20.4V to 30.4V incl. $\pm 10\%$ ripple) 36V DC <i>for less than 100 ms</i>
Protection	Reverse polarity protected Short circuit protected
Differential command signal max. command-current Input resistance Protected against overvoltage	-10V to +10V. See "Command Signal" table on next page 1 mA 10 k $\Omega$ $\pm 50$ volts
Output current per solenoid: rated max.	1.6A 1.8A
Output voltage at 1.6A output current	Typically 1.5V below supply voltage
Max. power consumption with one solenoid energized	35W
Ramp adjustment $\blacksquare$ range	50 ms to 5 sec
Deadband compensation $\blacksquare$ , independent for each solenoid Trigger level for deadband	200 to 700 mA $\pm 100$ mV
Gain adjustment $\blacksquare$ range, independent for each solenoid	0.04 to 0.14 A/V
PWM frequency	240 Hz (optimum for KD/TG4V-3(S) valves)
Installation and start-up guidelines	GB/D-9144
$\blacksquare$ <i>Vibration can cause potentiometer setting to change by up to approx. 5%. To avoid this effect, it is recommended to seal the adjusting screws (e.g. Loctite Screwlock 222).</i>	



# Installation Data

## Installation Data

**Mounting Interfaces****KDG5V-5** ISO 4401, size 05 with additional pilot ports. Refer to page B.140 for dimensional data.

**KDG5V-7** ISO 4401, size 07. Refer to page B.140 for dimensional data.

**KDG5V-8** ISO 4401, size 08. Refer to page B.140 for dimensional data.

**KDG5V-10** ISO 4401, size 10. Refer to page B.142 for dimensional data.

**Subplates**For KDG5V-5, see page B.145.

For KDG5V-7, see see page B.146.

For KDG5V-8, see see page B.146.

**DGAM-5 Pilot Ports Adaptor Module for KDG5V-5 Models**Provides for external connections to pilot ports if ports X and Y are not present in valve subplate/manifold block. For mounting bolts for valve plus adaptor, see below.

Max. pressure: 210 bar (3000 psi)

Model types:

DGAM-5-1\*-R: G $\frac{1}{4}$ " ( $\frac{1}{4}$ " BSPF) port  
tappings

DGAM-5-1\*-S:  $\frac{9}{16}$ "-18 UNF-2B port  
tappings

## Mounting Bolt Kits

**For KDG5V-5**

BK02-156493M (metric)

BK590720 (inch)

**For KDG5V-7**

BKDG7M (metric)

BK590724 (inch)

**For KDG5V-8**

BKDG8658M (metric)

BKDG8658 (inch)

**For KDG5V-10**

BK98613M (metric)

BK306 (inch)

**For KDG5V-10**

BKDG10636M (metric)

BKDG10636 (inch)

If not using Vickers recommended bolt kits, bolts used should be to ISO 898, 12.9 or better.

## Mounting Bolt Torques

Recommended torques with threads lubricated

**For KDG5V-5**

M6 or  $\frac{1}{4}$ "-20 UNC bolts:

To 210 bar (3000 psi) 14 Nm (10.3 lbf ft)

To 315 bar (4500 psi) 20 Nm (14.75 lbf ft)

**For KDG5V-7**

M10 or  $\frac{3}{8}$ "-16 UNC bolts:

49 to 59 Nm (36 to 43 lbf ft)

plus

M6 or  $\frac{1}{4}$ "-20 UNC bolts

9 to 14 Nm (6.6 to 10.3 lbf ft)

**For KDG5V-8**

M12 or  $\frac{1}{2}$ "-13 UNC bolts

103 to 127 Nm (76 to 93 lbf ft)

**For KDG5V-10**

M20 or  $\frac{3}{4}$ "-10 UNC-2B bolts

185-220 Nm (250-300 lbf ft)

## Mass (Weight)

Approx. for models with integral pilot pressure reducing module ("X" or "EX"see mode code).

KDG5V-5 9,5 kg (21 lb)

KDG5V-7 11,5 kg (25.3 lb)

KDG5V-8 20,2 kg (44.5 lb)

KDG5V10 54,5 kg (120.0 lb)

For models without integral pressure reducing module (No symbol, or "E", see model code), deduct 1,2 kg (2.6 lb).

# Application Data

## Fluid Cleanliness

Proper fluid condition is essential for long and satisfactory life of hydraulic components and systems. Hydraulic fluid must have the correct balance of cleanliness, materials and additives for protection against wear of components, elevated viscosity and inclusion of air.

Essential information on the correct methods for treating hydraulic fluid is included in Vickers publication 561; "Vickers Guide to Systemic Contamination Control," available from your local Vickers distributor or by

contacting Vickers, Incorporated. Recommendations on filtration and the selection of products to control fluid condition are included in 561.

Recommended cleanliness levels, using petroleum oil under common conditions, are based on the highest fluid pressure levels in the system and are coded in the chart below. Fluids other than petroleum, severe service cycles or temperature extremes are cause for adjustment of these cleanliness codes. See Vickers publication 561 for exact details.

Vickers products, as any components, will operate with apparent satisfaction in fluids with higher cleanliness codes than those described. Other manufacturers will often recommend levels above those specified.

Experience has shown, however, that life of any hydraulic components is shortened in fluids with higher cleanliness codes than those listed below. These codes have been proven to provide a long trouble-free service life for the products shown, regardless of the manufacturer.

Product	System Pressure Level bar (psi)		
	<70 (<1000)	70-210 (1000-3000)	210+ (3000+)
Vane Pumps – Fixed	20/18/15	19/17/14	18/16/13
Vane Pumps – Variable	18/16/14	17/15/13	
Piston Pumps – Fixed	19/17/15	18/16/14	17/15/13
Piston Pumps – Variable	18/16/14	17/15/13	16/14/12
<b>Directional Valves</b>	<b>20/18/15</b>	<b>20/18/15</b>	<b>19/17/14</b>
Pressure/Flow Control Valves	19/17/14	19/17/14	19/17/14
CMX Valves	18/16/14	18/16/14	17/15/13
Servo Valves	16/14/11	16/14/11	15/13/10
Proportional Valves	17/15/12	17/15/12	15/13/11
Cylinders	20/18/15	20/18/15	20/18/15
Vane Motors	20/18/15	19/17/14	18/16/13
Axial Piston Motors	19/17/14	18/16/13	17/15/12
Radial Piston Motors	20/18/14	19/17/13	18/16/13

## Hydraulic Fluids

Materials and seals used in these valves are compatible with antiwear hydraulic oils, and non-alkyl-based phosphate esters. The extreme operating viscosity range is 500 to 13 cSt (2270 to 70 SUS) but the recommended running range is 54 to 13 cSt (245 to 70 SUS).

## Fluid Temperatures

For mineral oil:

Min. .... -20°C (-4°F)

Max. " ..... +70°C (+158°F)

\* To obtain optimum service life from both fluid and hydraulic system, 65°C (150°F) normally is the maximum temperature.

Whatever the actual temperature range, ensure that viscosities stay within viscosities specified in the "Hydraulic Fluids" section.

## High Flow Proportional Directional Control Valves

KDG3V-5/7/8, 10 Series; Single-Stage with Hydraulic Pilot Operation

### Basic Characteristics

Max. pressure ..... up to 350 bar  
(5000 psi)

Max. flow rate ..... up to 700 L/min  
(190 USgpm)

Mounting interfaces to ISO 4401:

KDG3V-5 ..... Size 05u

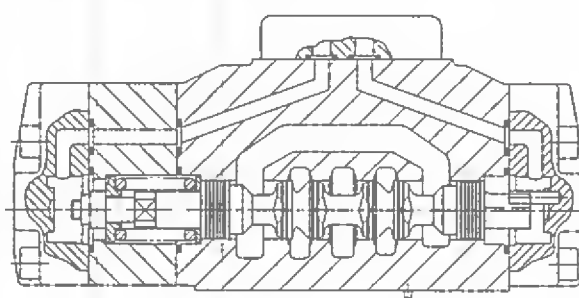
KDG3V-7 ..... Size 07

KDG3V-8 ..... Size 08

u With additional pilot ports X and Y.

### Typical Sectional Arrangement

KDG3V-7



### General Description

The remote control facility of these high flow capacity valves allows them to be installed in optimum locations relative to minimizing power transmission losses, close to actuators and distant from machine operators. Remote control can then be achieved using any suitable variable pressure control such as Vickers HRC type hydraulic remote controls which are available with a number of joystick and footpedal options and electrical switch features.

In KDG3V valves, the spool is centered by a spring when the differential of pilot pressures applied to the valve end chambers is less than approx. 6 bar (87 psi). As the pilot pressure differential

is increased the spool is moved from its centered position, and at approx. 12 bar (174 psi) differential the fluid flow path through the valve begins to open. The flow path opening then progressively increases, as the pressure is increased up to a level of approx. 30 bar (435 psi) differential, when the spool reaches the end of its travel. Further increase in pilot pressure (up to the maximum permissible) has no further effect on the output characteristics.

Good symmetrical characteristics for each direction of spool travel are achieved by using the same spring for each direction of spool travel.

Specially profiled metering notches on the spool give smooth, progressive opening/closing of the flow paths.

Vickers KDG3V valves offer ideal solutions for applications with repetitive load conditions, or where the load is under direct control of the machine operator.

Details of electrically operated two-stage models, types KDG5V and KADG5V can be found in general catalog 2005B section H, or product catalog 2325A.

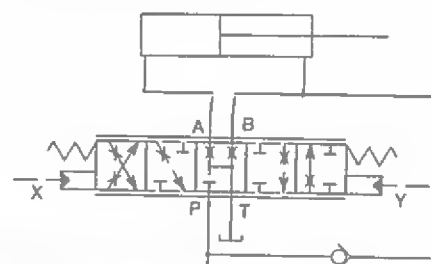
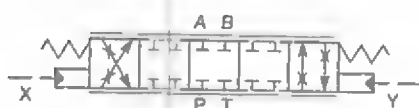
### Functional Symbols

Transient flow conditions shown by dotted lines

Spool type 2C

Spool type 33C

Spool type 133C, with typical regenerative circuit



## Model Codes

**KDG3V - \* - \*\*\* C \*\*\* N (\*\*\*) - 1\***



### 1 Mounting interface, ISO 4401

5 = Size 05

7 = Size 07

8 = Size 08

### 2 Spool type

See Functional Symbols, previous page.

2 = All ports blocked when spool is centered

33 and 133 = Bleed A and B to T when spool is centered

### 3 Spool control

C = Spool spring centered

### 4 Spool type

See adjacent table.

Flow rating (L/min) for symmetric spools; "A" port flow rating for asymmetric spools

### 5 Spool type

See Functional Symbols, previous page.

N = meter-in and meter-out

### 6 Spool type

See adjacent table.

"B" port flow rating for asymmetric spools

### 7 Design number, 1\* series

Subject to change. Installation dimensions unaltered for design numbers 10 to 19 respectively.

## Spool Types and Flow Ratings

Flow ratings for flow through P-A-B-T at  $\Delta p = 5$  bar (72 psi) per flow path, e.g. P-A or B-T. For other pressure drops see "Flow Gain" curves.

### Symmetric Spools

Spool code	Symbol	Flow rating
For KDG3V-5 valves:		
2C90N	2C	85 L/min (22 USgpm)
33C80N	33C	75 L/min (20 USgpm)
For KDG3V-7 valves:		
2C180N	2C	180 L/min (48 USgpm)
33C170N	33C	170 L/min (45 USgpm)
For KDG3V-8 valves:		
2C280N	2C	280 L/min (74 USgpm)
33C270N	33C	270 L/min (71 USgpm)

### Asymmetric Spools

Figure preceding metering type designator, "N" (e.g. 2C\*\*\*N) is "A" port flow rating, i.e. P-A, or A-T; figure after "N" (N\*\*\*) is "B" port flow rating, i.e. P-B or B-T.

Spool code	Symbol	Flow rating
For KDG3V-5 valves:		
2C70N45	2C	70 L/min (18.5 USgpm), "A" port flow 45 L/min (12 USgpm), "B" port flow
For KDG3V-7 valves:		
2C180N100	2C	180 L/min (48 USgpm), "A" port flow 100 L/min (26 USgpm), "B" port flow
For KDG3V-8 valves:		
33C250N170	33C	250 L/min (66 USgpm), "A" port flow 170 L/min (45 USgpm), "B" port flow
133C250N170	133C	250 L/min (66 USgpm), "A" port flow 170 L/min (45 USgpm), "B" port flow

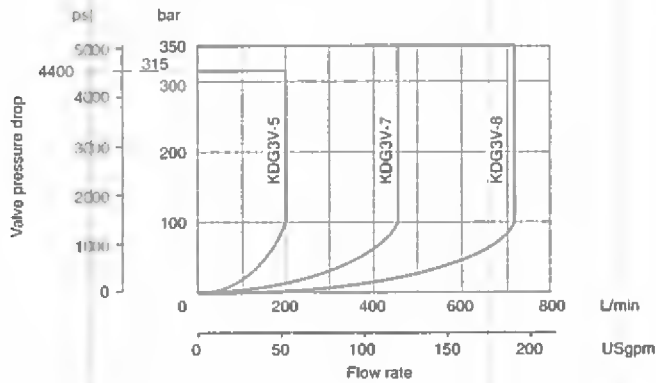
Operating Data

Data is typical with fluid at 36 cSt (168 SUS) and 50°C (122°F)

Max pressure, all ports: For KDG3V-5	315 bar (4500 psi)
For KDG3V-7/8	350 bar (5000 psi)
Pilot pressure for control	See this page
Flow rating	See 4 and 5 in model code
Flow gain	See next page
Power capacity envelopes	See this page
Mass:	kg (lb)
KDG3V-5	8,2 (18)
KDG3V-7	10,2 (22.5)
KDG3V-8	18,9 (41.6)

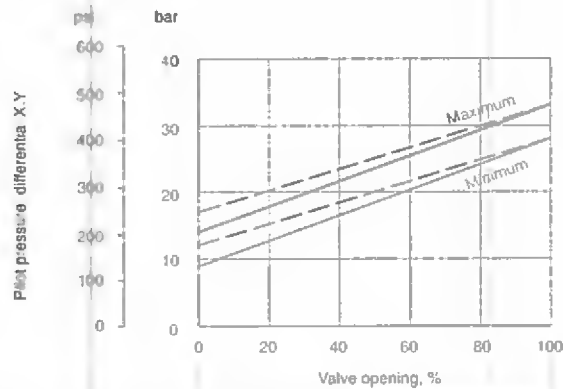
Power Capacity Envelopes

KDG3V-5/7/8 valves are not recommended for applications where flow/pressure drop is outside of these envelopes



Pilot Pressure for Control

Spool type 2C: \_\_\_\_\_  
Spool types 33C and 133C: - - - -



Hydraulic Fluids

Materials and seals used in these valves are compatible with antiwear hydraulic oils, water-glycols, water-in-oil emulsions and non-alkyl-based phosphate esters. The extreme operating range is 500 to 13 cSt (2270 to 70 SUS) but the recommended running range is 54 to 13 cSt (245 to 70 SUS). For further technical information about fluids see "Technical Information" leaflet B-920 or I-286S.

Filtration Requirements

Recommendations on filtration methods and the selection of products to control fluid condition are included in Vickers publication 561 or 9132.

For products in this catalog the recommended fluid cleanliness levels are:  
Up to 138 bar (2000 psi) . . . . 17/15/12  
Above 138 bar (2000 psi) . . . . 15/13/11

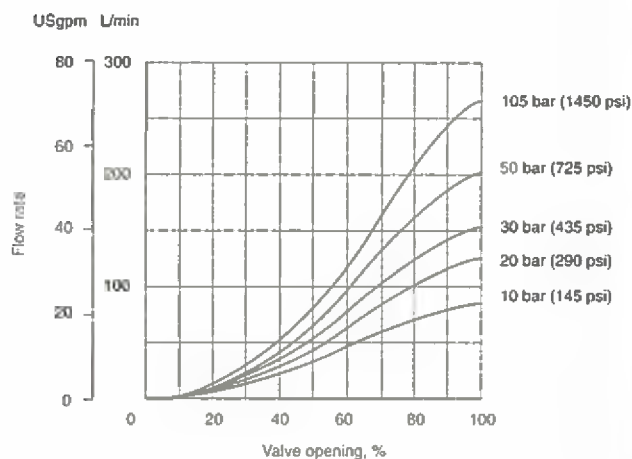
Fluid Temperatures

For petroleum oil:  
Min. . . . . -20°C (-4°F)  
Max.\* . . . . +70°C (+158°F)  
\* To obtain optimum service life from both fluid and hydraulic system, 65°C (150°F) normally is the maximum temperature.

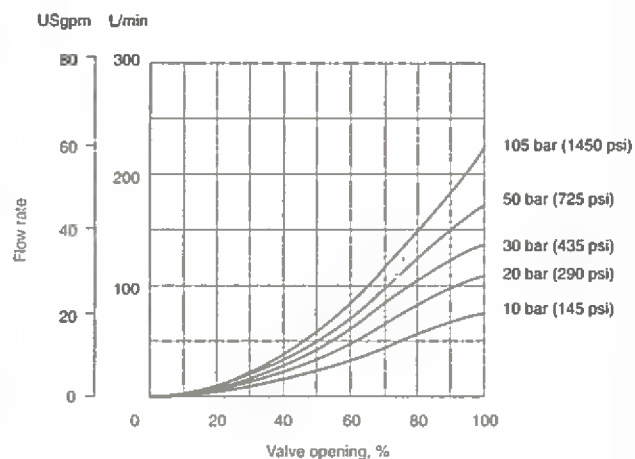
For other fluids where limits are outside those of petroleum oil, consult fluid manufacturer or Vickers representative. Whatever the actual temperature range, ensure that viscosities stay within those specified under "Hydraulic Fluids".

# Flow Gain Curves

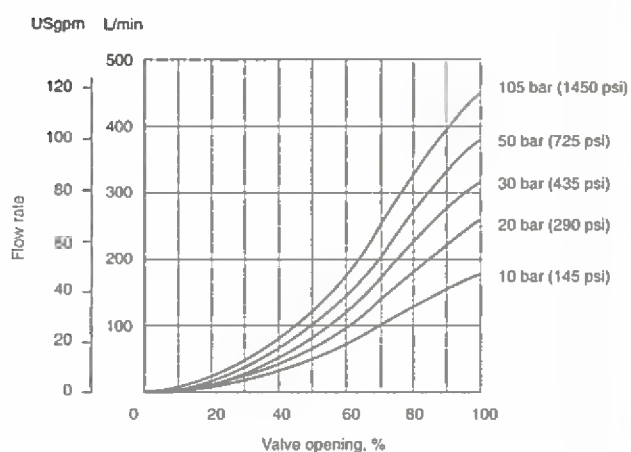
**KDG3V-5-2C90N**



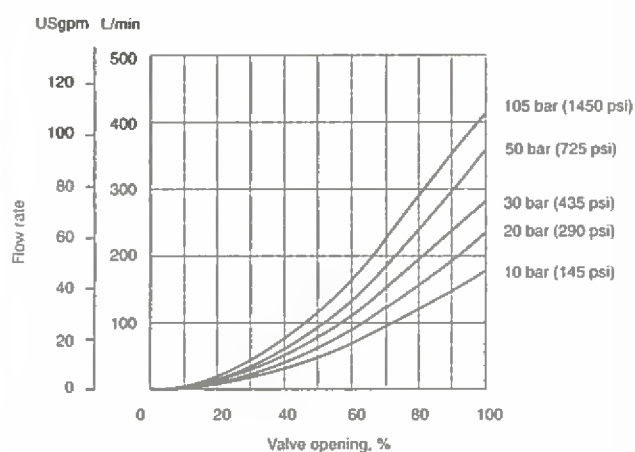
**KDG3V-5-33C80N**



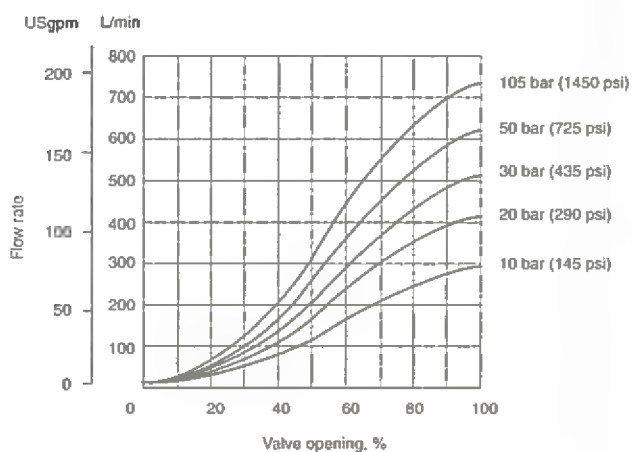
**KDG3V-7-2C180N**



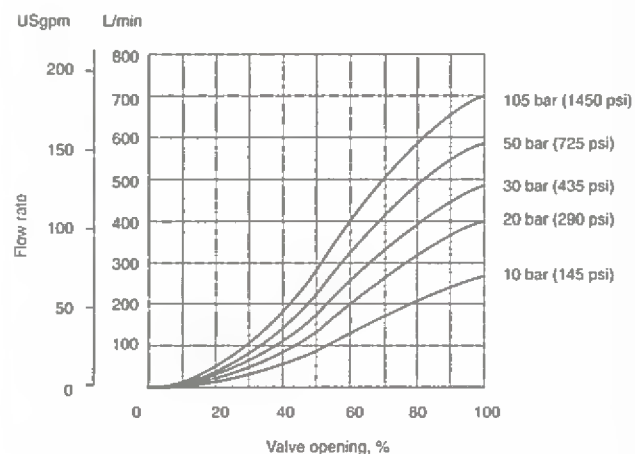
**KDG3V-7-33C170N**



**KDG3V-8-2C280N**



**KDG3V-8-33C270N**





## Installation Dimensions in mm (inches)

### KDG3V-5

Dimensions of ISO 4401 size 05 interface, with additional ports X and Y, plus details of Vickers subplates, DGAM-5-1\*, X and Y port adaptor block, etc., can be found in general catalog 2005, section J, or product catalog 2336.

#### Mounting Bolt Kits

Metric, M6 ..... BKDG01633M

Inch, 1/4"-20 UNC ..... BKDG01633

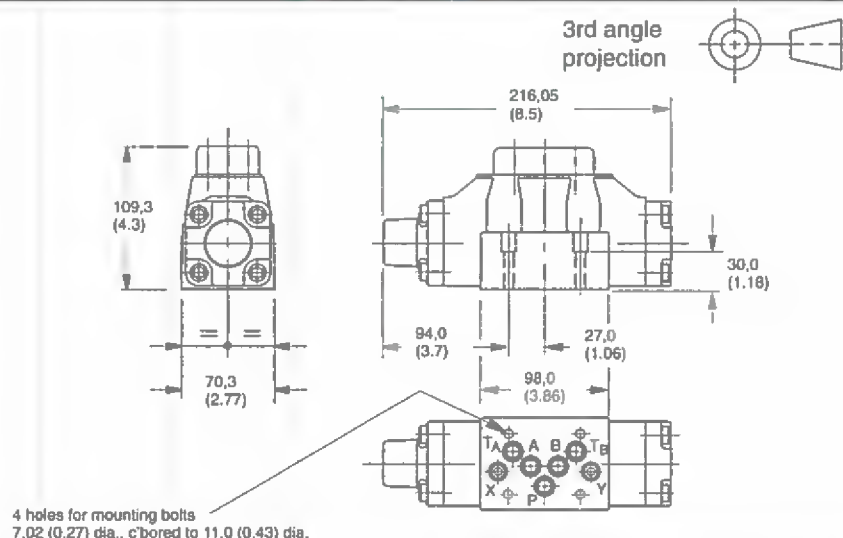
#### Torque Data

Up to 210 bar (3000 psi)

..... 14 Nm (10.3 lbf ft)

Up to 315 bar (4500 psi)

..... 20 Nm (14.75 lbf ft)



### KDG3V-7

Dimensions of ISO 4401 size 07 interface, and details of Vickers subplates, can be found in general catalog 2005, section J, or product catalog 2337.

#### Mounting Bolt Kits

Metric, 4 x M10 plus 2 x M6

..... BKDG7858918

Inch, 4 x 3/8"-16 UNC plus 2 x 1/4"-20

UNC ..... BKDG01633

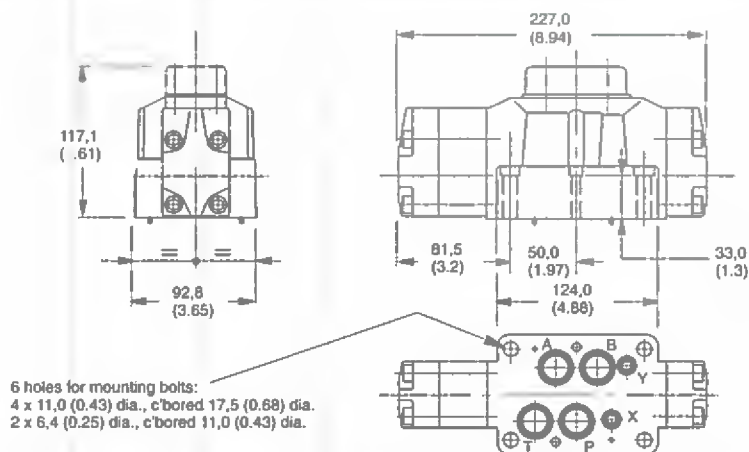
#### Torque Data

M10; 3/8"-16 UNC ..... 49-59 Nm

..... (36-43 lbf ft)

M6; 1/4"-20 UNC ..... 9-14 Nm

..... (6.6-10.3 lbf ft)



### KDG3V-8

Dimensions of ISO 4401 size 08 interface, and details of Vickers subplates, can be found in general catalog 2005, section J, or product catalog 2338.

#### Mounting Bolt Kits

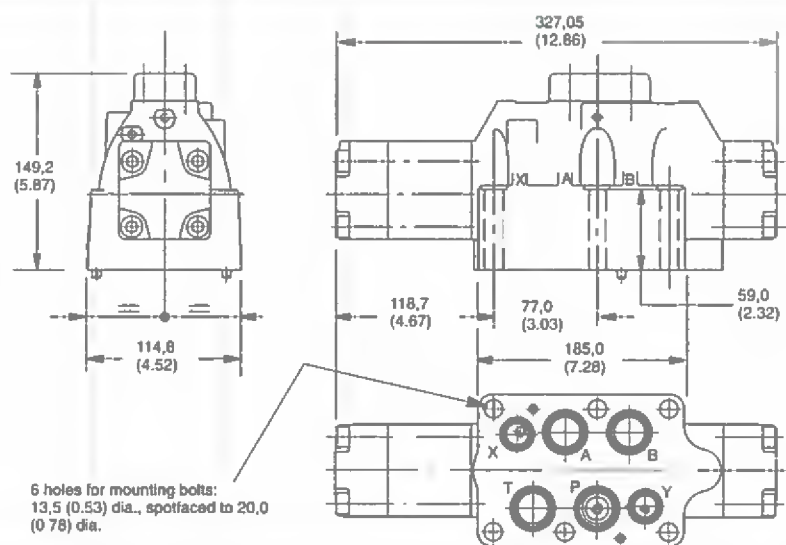
Metric, M12 ..... BKDG06635M

Inch, 1/2"-13 UNC ..... BKDG06635

#### Torque Data

M12; 1/2"-13 UNC ..... 103-127 Nm

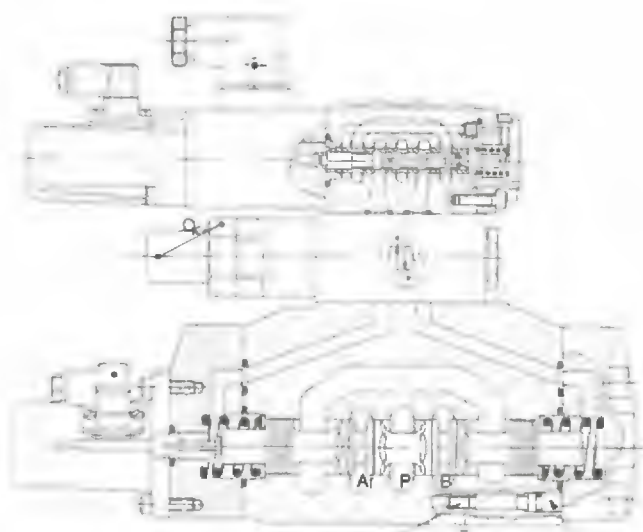
..... (76-93 lbf ft)



## Proportional Directional Valves, Two-Stage

**K(A)FDG5V-5/7/8, 1<sup>1</sup>/<sub>3</sub>" Series, with Main-Stage Feedback Transducers**  
**K(A)HDG5V-5/7/8, 2" Series, with Pilot and Main-Stage Feedback Transducers**  
**ISO 4401-05, 07 and 08 (ANSI/NFPA-D05, D07 and D08)**

Typical cross section  
KHDG5V-7



M6 x 8mm plug part no. 471131, size 7 only.  
Remove for internally piloted models

M5 internal thread for  
removal of closure plug

### General Description

Vickers proportional valves shown in this catalog are suitable for working pressures up to 350 bar (5070 psi) and flow rates up to 300 L/min (79 US gpm).

They are designed to provide a controlled oil flow in proportion to a command signal, with spool position feedback to provide accurate speed control. Hydrostats are available for load compensation on sizes 7 and 8.

Additionally, these valves can be supplied with or without an integral amplifier built directly onto the valve.

### KF/HDG5V-5/7/8

This version is supplied without the integral amplifier.

#### Features and Benefits

- Wide range of spool and flow rate options
- Supported by amplifiers and auxiliary function modules from the Vickers range
- Electronic feedback LVDT ensures accurate speed control
- Current feedback provides inherent protection from electrical interference
- Vibration and shock tested

### KAF/HDG5V-5/7/8

A range of proportional directional valves with control amplifiers built directly on, and prewired to, the valves. Factory-set adjustments of gain, spool deadband compensation, dither and offset ensure high repeatability valve-to-valve.


The only electrical inputs required are power supply (24V) and a voltage command signal of  $\pm 10V$ . The amplifier is housed in a robust metal enclosure. Electrical connections are via a standard 7-pin plug.

Two LEDs give status of "Power-on" (green) and LVDT failure indication (red). A monitor point allows the function of the amplifier to be checked. Ramp functions, if required, must be generated externally.

#### Features and Benefits

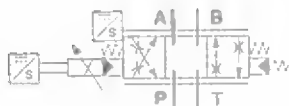
- Factory-sealed adjustments increase valve-to-valve accuracy
- Valve and amplifier selected, ordered, delivered and installed as a performance-tested package
- Standard 24V DC supply with wide tolerance band
- Standard  $\pm 10V$  DC command signals
- Installation wiring reduced and simplified
- Standard 7-pin connector
- LED status indication and monitor point help troubleshooting
- Simple valve removal and replacement for service
- Vibration and shock tested
- Supported by auxiliary function modules



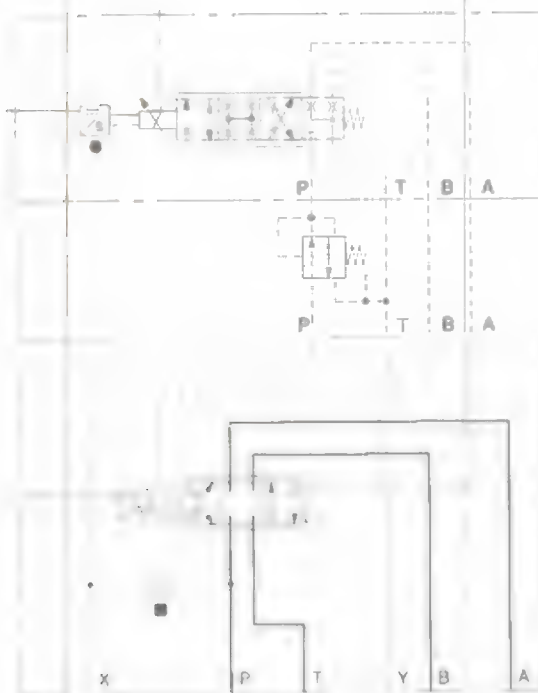
*This product has been designed and tested to meet specific standards outlined in the European Electromagnetic Compatibility Directive (EMC) 89/336/EEC, amended by 91/263/EEC, 92/31/EEC and 93/68/EEC, article 5. For instructions on installation requirements to achieve effective protection levels, see this leaflet, the Installation Wiring Practices for Vickers Electronic Products leaflet 2468 and leaflet 02-123931A which is packed with every KA valve. Wiring practices relevant to this Directive are indicated by  Electromagnetic Compatibility (EMC).*

# Functional Symbols and Application Notes

## Model Types KHDG5V Shown Simplified symbol



Detailed symbol



## Spool Types



Type 2



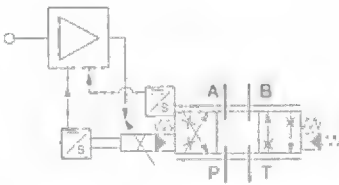
Type 33



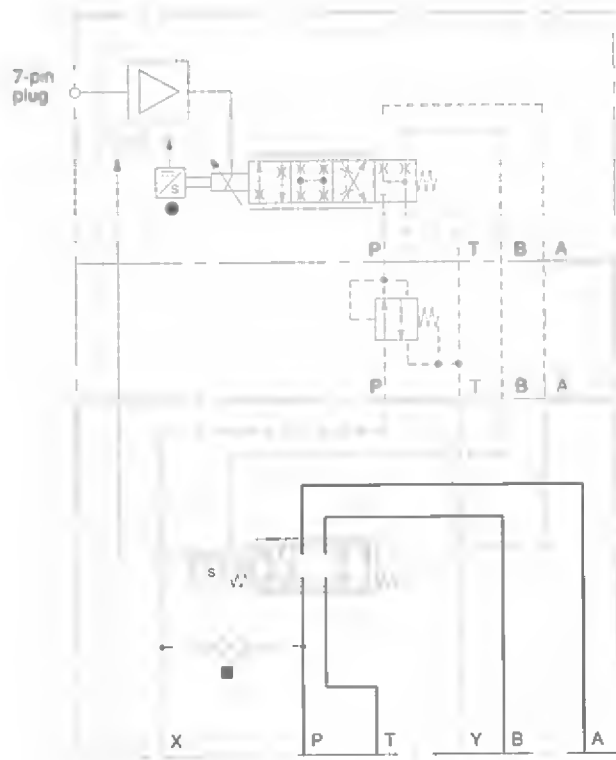
Type 5

■ See Application Note B, and (S) in Model Code on next page.

## Model Types KAHDG5V Shown K(A)FDG5V symbols identical, but omit pilot-stage LVDT ● Simplified symbol



Detailed symbol



## Application Notes

### A. Main-Spool Options

Spools shown are meter-in/meter-out types. Center-condition options are types 2 and 33.

### B. Internally Piloted Models

Differ from detailed symbols above by omission of plug n and the blocking of port X by the mating surface.

## Model Code

**K(A) \* DG5V - \* - \*\* - C - \*\*\*\*\* - (E) X - VM - \*\* - \*\*\* - H1 - \*\***



### 1 Series type designator

A = Integral amplifier  
Omit for non-integral amplifier

### 2 Feedback arrangement

F = From main stage only  
H = From pilot and main stages

### 3 Mounting size code (ISO 4401)

5 = 05  
7 = 07  
8 = 08

### 4 Spool type, flow rating and metering

See "Functional Symbols" on previous page

$\Delta p = 5$  bar (72 psi) per metering flow path, e.g. B to T

#### Symmetric spools

For K\*DG5V-5 valves:

2C100N = 100 L/min (26 US gpm)  
33C80N = 80 L/min (21 US gpm)  
5C85N = 85 L/min (22 US gpm)

For K\*DG5V-7 valves:

2C200N = 200 L/min (52 US gpm)  
33C160N = 160 L/min (42 US gpm)  
5C200N = 200 L/min (52 US gpm)

For K\*DG5V-8 valves:

2C300N = 300 L/min (79 US gpm)  
33C270N = 270 L/min (71 US gpm)  
5C300N = 300 L/min (79 US gpm)

#### Asymmetric spools

First figure (\*\*N) is flow rating P-A, or A-T ("A" port flow); last figure (N\*\*) is flow rating P-B, or B-T ("B" port flow)

For K\*DG5V-5 valves:

2C70N45 = 70 L/min (18.5 US gpm), "A" port flow  
45 L/min (11.9 US gpm), "B" port flow  
33C65N40 = 65 L/min (17.2 US gpm), "A" port flow  
40 L/min (10.6 US gpm), "B" port flow

For K\*DG5V-7 valves:

2C150N85 = 150 L/min (40 US gpm),  
"A" port flow  
85 L/min (22.4 US gpm), "B" port flow  
33C130N65 = 130 L/min (33.3 US gpm), "A" port flow  
65 L/min (17.2 US gpm), "B" port flow

For K\*DG5V-8 valves:

2C280N200 = 280 L/min (74 US gpm),  
"A" port flow  
200 L/min (52 US gpm),  
"B" port flow  
33C250N170 = 250 L/min (66 US gpm),  
"A" port flow  
170 L/min (45 US gpm),  
"B" port flow

### 5 Pilot supply

EX = External through integral reducer  
X = Internal through integral reducer

### 6 Solenoid electrical connector

U1 = ISO 4400/DIN 43650, non-integral amplifier type only  
F = Flying lead, integral amplifier type only

### 7 Electrical connection (KAF valves only)

PD7 = 7-pin connector with plastic plug.  
See Warning note below.

### 8 Design number

10 series for K(A)FDG5V-7/8 models  
20 series for K(A)H models  
30 series for K(A)FDG5V-5 models  
Subject to change. Installation dimensions unaltered for design numbers \*0 to \*9 inclusive.

### Solenoid and LVDT Plugs

Supplied with valve.



#### Warning

To conform to the EC Electromagnetic Compatibility directive (EMC) this KA valve must be fitted with a metal 7-pin plug. The screen of the cable must be securely connected to the shell of the metal connector. A suitable IP67 rated connector is available from Vickers, part no. 934939. Alternatively a non IP67 rated connector is available from ITT-Cannon, part no. CA 02 COM-E 14S A7 P.

Additionally the cable must be fitted with a ferrite EMC suppression core not more than 4cm from the connector referred to above. Suitable types include Farnell 535-898 or Farnell 535-904 which snap fit over the cable.

The plastic plug, part number 694534, is only suitable for use in a sealed electromagnetic environment or outside of the European Community.

## Operating Data

Performance data is typical with fluid at 36 cSt (168 SUS) and 50°C (122°F) while using the basic Vickers power amplifier.

### KF/HDG5V and KAF/HDG5V Valves

Relative duty factor	Continuous rating (ED = 100%)
Hysteresis, with flow through P-A-B-T, $\Delta p = 5$ bar (72 psi) per metering path (P-A or B-T): KFDG5V KHDG5V	<2% <1%
Step input response, with flow through P-A-B-T, $\Delta p = 5$ bar (72 psi) per metering path, e.g. P-A Required flow step:	Time to reach 90% of required step:
K(A)FDG5V-5 0 to 100% 100% to 0 +90 to -90%	30 ms (0.030s) 24 ms (0.024s) 34 ms (0.034s)
K(A)FDG5V-7 0 to 100% 100% to 0 +90 to -90%	50 ms (0.050s) 54 ms (0.054s) 61 ms (0.061s)
K(A)FDG5V-8 0 to 100% 100% to 0 +90 to -90%	67 ms (0.067s) 56 ms (0.056s) 75 ms (0.075s)
K(A)HDG5V-5 0 to 100% 100% to 0 +90 to -90%	24 ms (0.024s) 23 ms (0.023s) 35 ms (0.035s)
K(A)HDG5V-7 0 to 100% 100% to 0 +90 to -90%	24 ms (0.024s) 23 ms (0.023s) 36 ms (0.036s)
K(A)HDG5V-8 0 to 100% 100% to 0 +90 to -90%	37 ms (0.037s) 36 ms (0.036s) 57 ms (0.057s)
Mass	
KFDG5V-5	9,50 kg (20.9 lb) approx.
KAFDG5V-5	9,90 kg (21.8 lb) approx.
KFDG5V-7	10,75 kg (23.7 lb) approx.
KAFDG5V-7	11,15 kg (24.6 lb) approx.
KFDG5V-8	18,00 kg (39.7 lb) approx.
KAFDG5V-8	18,40 kg (40.6 lb) approx.
KHDG5V-5	9,75 kg (21.5 lb) approx.
KAHDG5V-5	10,15 kg (22.4 lb) approx.
KHDG5V-7	11,00 kg (24.2 lb) approx.
KAHDG5V-7	11,40 kg (25.1 lb) approx.
KHDG5V-8	18,25 kg (40.2 lb) approx.
KAHDG5V-8	18,65 kg (41.1 lb) approx.
Installation and start-up	See "Further Information"

<b>KF/HDG5V Valves</b>	
Max. current, at 50°C (122°F) ambient	2,7A
Standing current, pilot valve at null: KFDG5V KHDG5V	1,4A 1,6A
Coil resistance, at 20°C (68°F): KFDG5V KHDG5V	2,8Ω 1,7Ω
Electrical plugs, supplied with valve	See "Installation Dimensions"
<b>KAF/HDG5V Valves</b>	
Power supply	24V DC (21V to 36V including 10% peak-to-peak max. ripple) max. current 3A
Command signal Input impedance	0 to +10V DC, or 0 to -10V DC, or -10V to +10V DC 47 kΩ
7-pin plug connector Pin connections: A B C D E F G	Power supply +ve Power 0V Signal 0V +ve voltage command signal -ve voltage command signal Monitor output Protective ground
Electro-magnetic compatibility (EMC): Emission Immunity See "Important" note regarding EMC, five pages on	EN 50081-2 EN 50082-2
Gain adjustment	25 to 125%
Zero adjustment	± 18%
Factory-set adjustments	Deadband, gain, dither and offset
Monitor point signal: Output impedance	± 10V for full stroke output stage spool 10 kΩ
Power stage PWM frequency	2 kHz nominal
Repeatability, valve-to-valve (at factory settings): Flow gain at 100% command signal	Optimised by adjustment of deadband compensation, gain and ramp potentiometers on associated Vickers amplifier
Protection: Electrical	Reverse polarity protected
Relative humidity	85 to 95% at 20 to 70°C (68 to 158°F)
Supporting products: Auxiliary electronic modules (DIN-rail mounting): EHA-CON-201-A-1* signal converter EHA-DSG-201-A-1* command signal generator EHA-RMP-201-A-1* ramp generator EHA-PID-201-A-1* PID controller Subplates, size 05, 07 and 08 Mounting bolts Note: If not using Vickers recommended bolt kits, bolts must be to ISO 898 grade 12.9 or stronger	See catalog 2410 See catalog 2410 See catalog 2410 See catalog 2410 See catalogs 2336, 2337 and 2338 See catalog 2314



## Maximum Pressures, bar (psi)

Model	Pilot Pressure Source	Ports P, A and B	T	X	Y
K(A)FDG5V-7/8	Internal or external	350 (5000) •	350 (5000)	350 (5000) •	4 (58)
K(A)*DG5V-5	External	315 (4500)	210 (3000)	210 (3000) ▪	4 (58)
	Internal	315 (4500) •	100 (1450)	315 (4500) ▪	4 (58)
K(A)HDG5V-7/8	Internal or external	350 (5000) ▪	350 (5000)	350 (5000) ▪	4 (58)

• 25 (363) min. pressure at X for externally piloted models or at P and X for internally piloted models.

▪ 45 (653) min. pressure at X for externally piloted models or at P and X for internally piloted models.

## Minimum Recommended Flow Rates

For spool types 2C and 33C

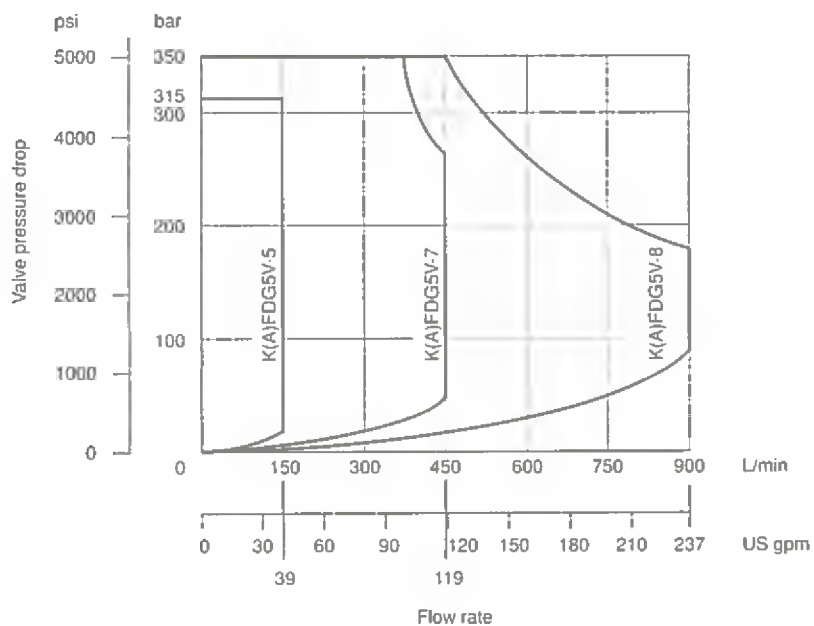
$\Delta p = 10$  bar (145 psi) for looped flow P-A-B-T (or P-B-A-T)

Valve Size/Spool Code	Min. Flow Rate	
	L/min	in <sup>3</sup> /min
K(A)FDG5V-5-2C100N	1,0	60
K(A)FDG5V-5-33C80N	1,0	60
K(A)FDG5V-7-2C200N	2,0	121
K(A)FDG5V-7-33C160N	2,0	121
K(A)FDG5V-8-2C300N	3,0	182
K(A)FDG5V-8-33C270N	3,0	182
K(A)HDG5V-5-2C100N	0,5	30
K(A)HDG5V-5-33C80N	0,5	30
K(A)HDG5V-7-2C200N	1,0	60
K(A)HDG5V-7-33C160N	1,0	60
K(A)HDG5V-8-2C300N	1,5	91
K(A)HDG5V-8-33C270N	1,5	91

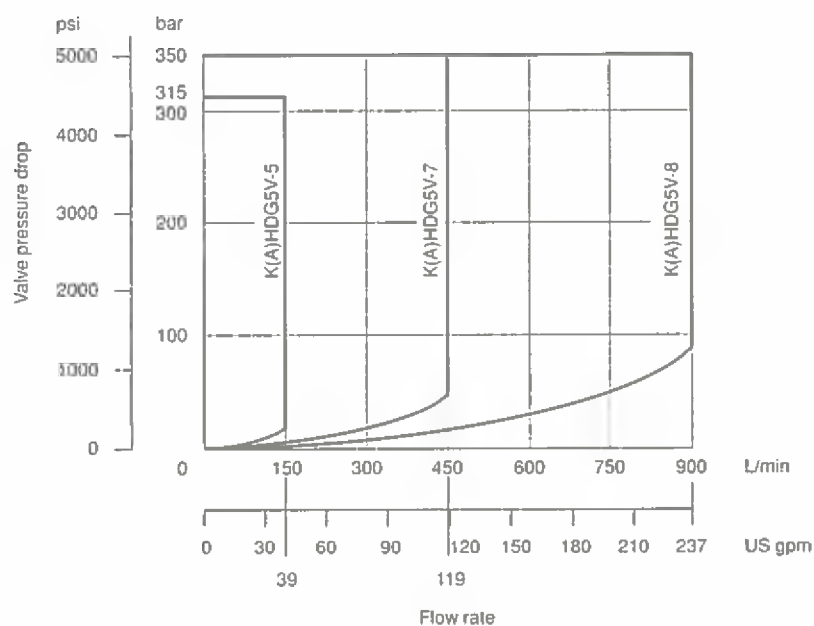
## Power Capacity Envelopes

Flow through P-A-B-T or P-B-A-T

KF models

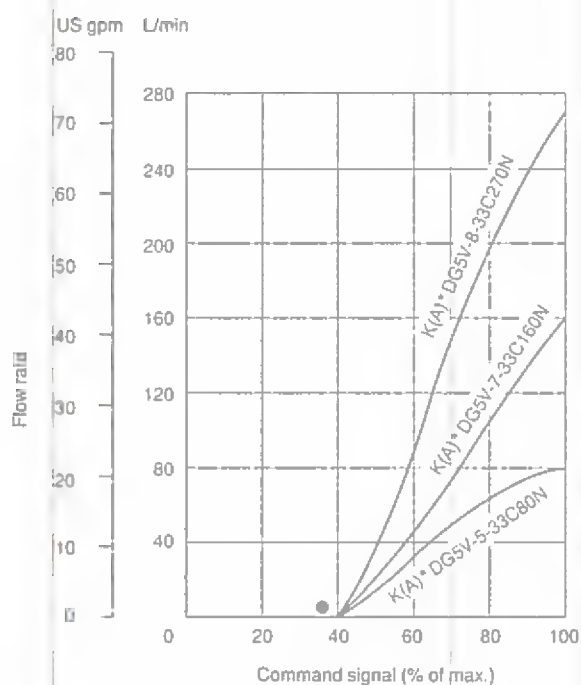
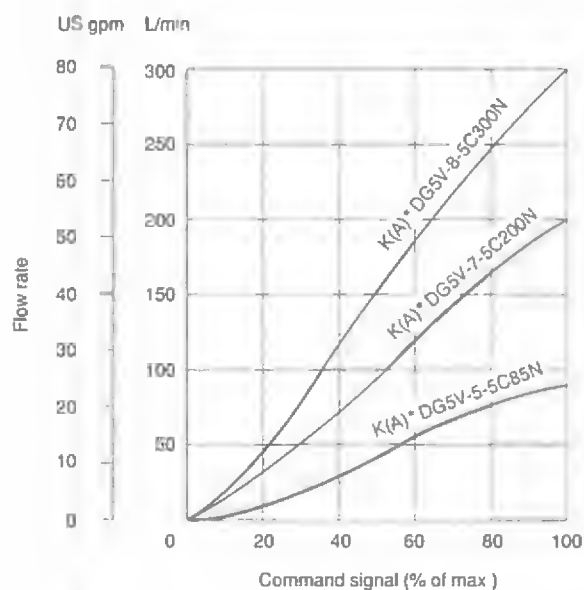
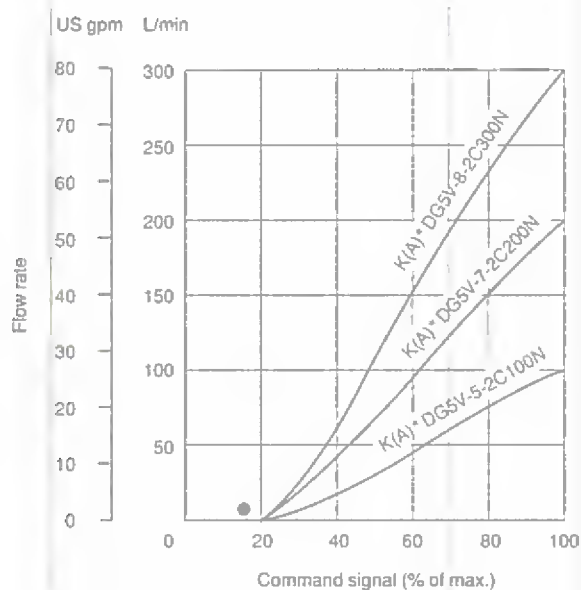


KH models



## Flow Gain KFDG5V and KHDG5V Models

At  $\Delta p = 5$  bar (72 psi) per metering path (e.g. P-A) n, with flow through P-A-B-T or P-B-A-T. Percentage command signals applicable for positive and negative values of command signal. See footnote (●) relative to point at which flow starts.



● These points will vary from valve to valve, but can be adjusted using the deadband compensation feature of the drive amplifier

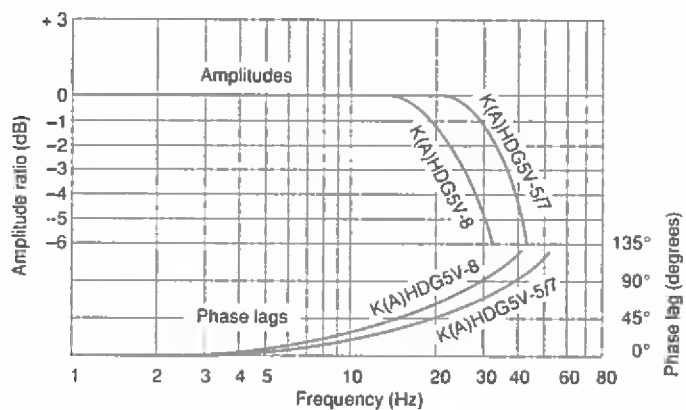
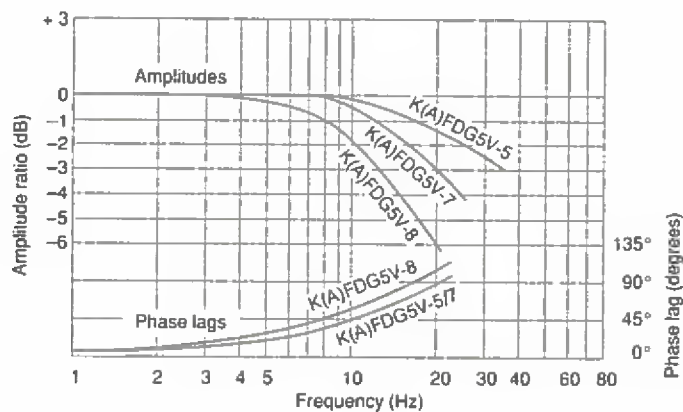
At other  $\Delta p$  values, flow rates approximate to:

$$Q_x = Q_D \sqrt{\frac{\Delta p_x}{\Delta p_D}}$$

where  $Q_D$  = Datum flow rate  
 $\Delta p_D$  = Pressure drop at datum flow rate  
 $\Delta p_x$  = Required  $\Delta p$

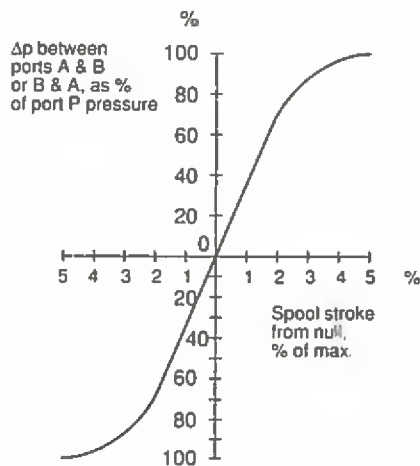
## Frequency Response, Typical

For an amplitude of  $\pm 25\%$  of max. stroke (center-to-offset) about the 50% position



## Pressure Gain

K(A)F/HDG5V-5C\*\*\*N



## Electrical Block Diagram

### Command Signals and Outputs

7-pin plug Pin D	Pin E	Flow direction
Positive	0V	P to A
0V	Negative	
$U_D - U_E = \text{Positive}$		
Negative	0V	P to B
0V	Positive	
$U_D - U_E = \text{Negative}$		

### KAF/HDG5V-\*

#### Wiring

Connections must be made via the 7-pin plug mounted on the amplifier.  
Recommended cable sizes are:

#### Power cables:

For 24V supply

0,75 mm<sup>2</sup> (18 AWG) up to 20m (65 ft)

1,00 mm<sup>2</sup> (17 AWG) up to 40m (130 ft)

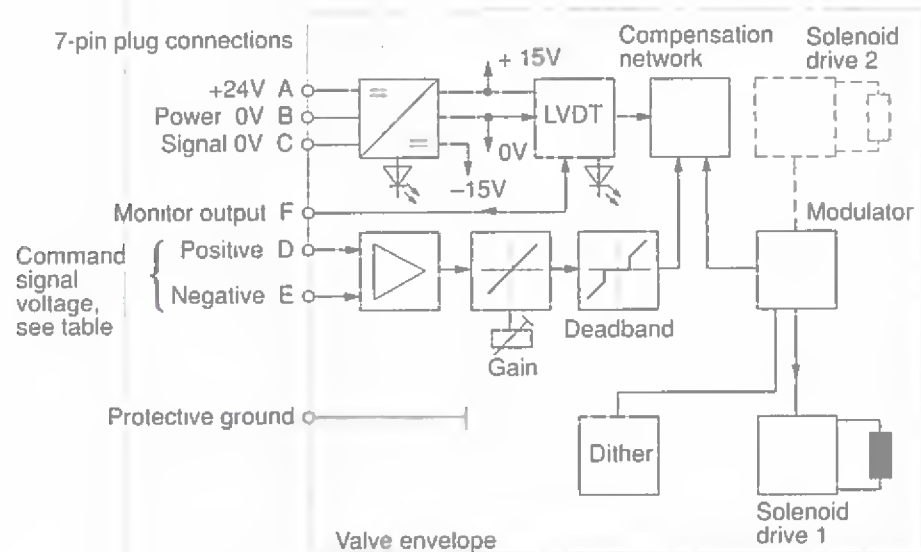
#### Signal cables:

0,50 mm<sup>2</sup> (20 AWG)

#### Screen:

A suitable cable would have 7 cores, a separate screen for signal wires and an overall screen.

See wiring connection diagrams on page B.183

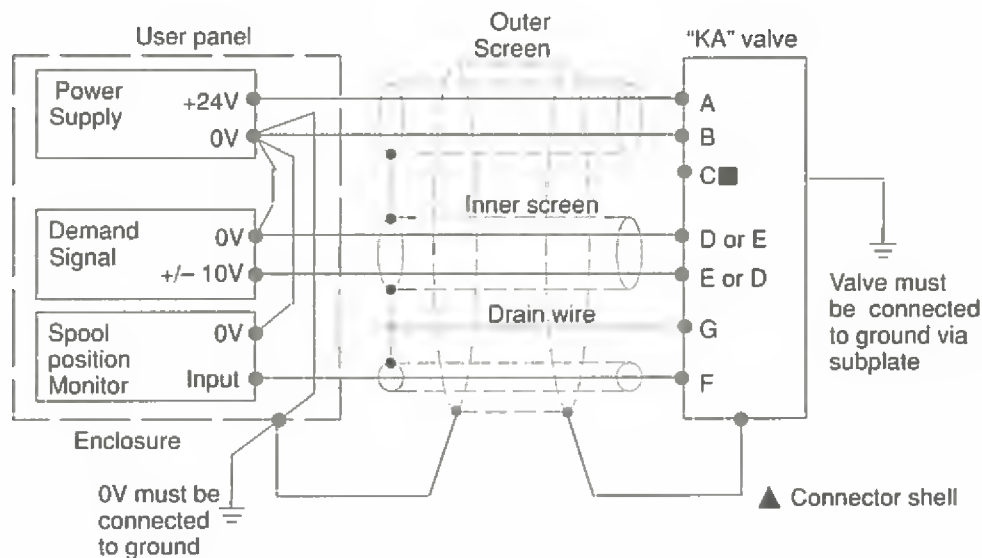


#### Warning

All power must be switched off before connecting or disconnecting any plugs.

# Wiring Connection

## Wiring Connections for Valves with Integral Amplifier



■ Spool position monitor voltage (pin F) will be referenced to the KA valve local ground. A "local ground" (pin C) is provided for optional use by differential input customer supplied electronics.

▲ Note: In applications where the valve must conform to European RFI/EMC regulations, the outer screen (shield) must be connected to the outer shell of the 7-pin connector and the valve body must be fastened to the earth ground. Proper earth grounding practices must be observed in this case, as any differences in command source and valve ground potentials will result in a screen (shield) ground loop.



### Warning

Do not ground pin C. If the local ground (pin C) is not used for differential monitor electronics, do not use. Read monitor pin F with respect to ground.



### Warning

Electromagnetic Compatibility (EMC)

It is necessary to ensure that the valve is wired-up as above. For effective protection, the user electrical cabinet, the valve subplate or manifold, and the cable screens should be connected to efficient ground points. The metal 7-point connector, part no. 934939, should be used for the integral amplifier.

In all cases, both valve and cable should be kept as far as possible from any sources of electromagnetic radiation such as cables carrying heavy current, relays and certain kinds of portable radio transmitters, etc. Difficult environments could mean that extra screening may be necessary to avoid the interference.

It is important to connect the 0V lines as shown above. The multi-core cable should have at least two screens to separate the demand signal and monitor output from the power lines.



## Installation Dimensions in mm (inches)

### KAF and KAH Models

All KAF and KAH models have amplifier housing, connector plug and wiring adaptor, mounted on top of pilot stage.

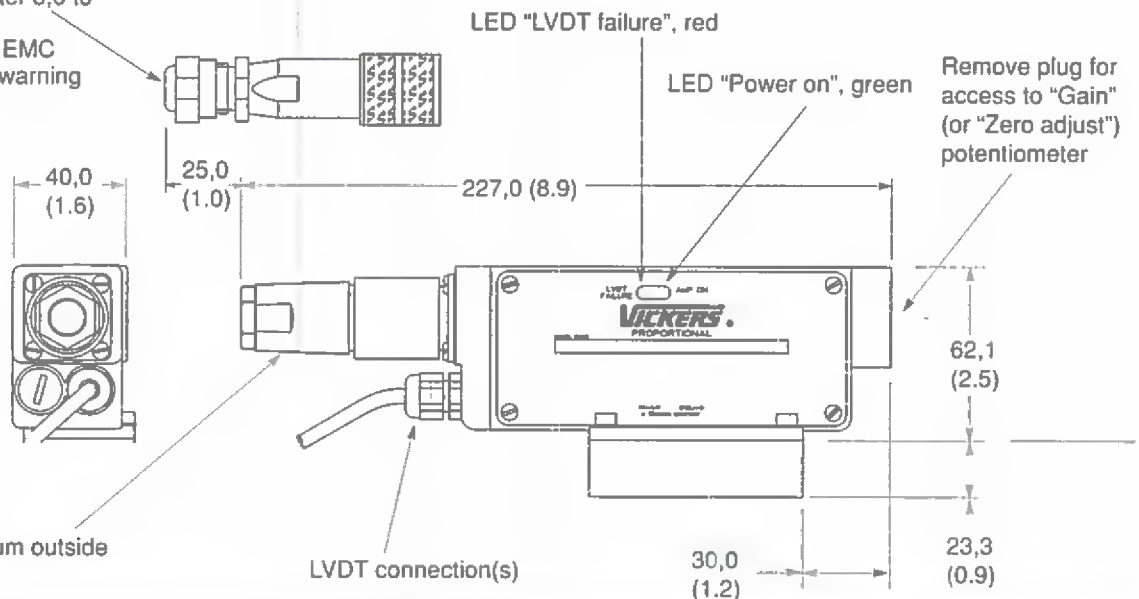
3rd angle  
projection



For overall valve dimensions, refer to individual valve drawings.

#### Metal plug 934939

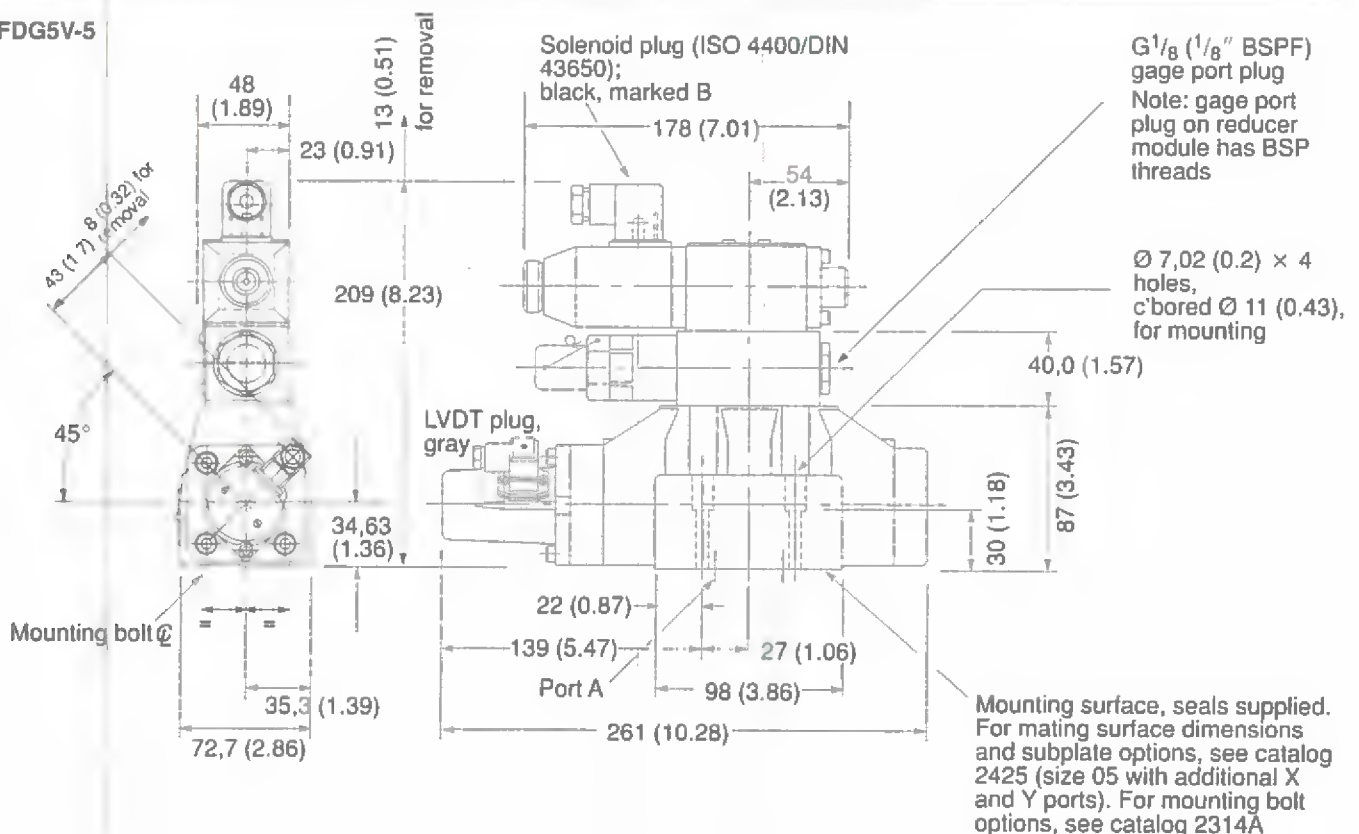
Cable outside diameter 8,0 to 10,5 (0.31 to 0.41)  
Must be used for full EMC protection. See also warning note on page B.175



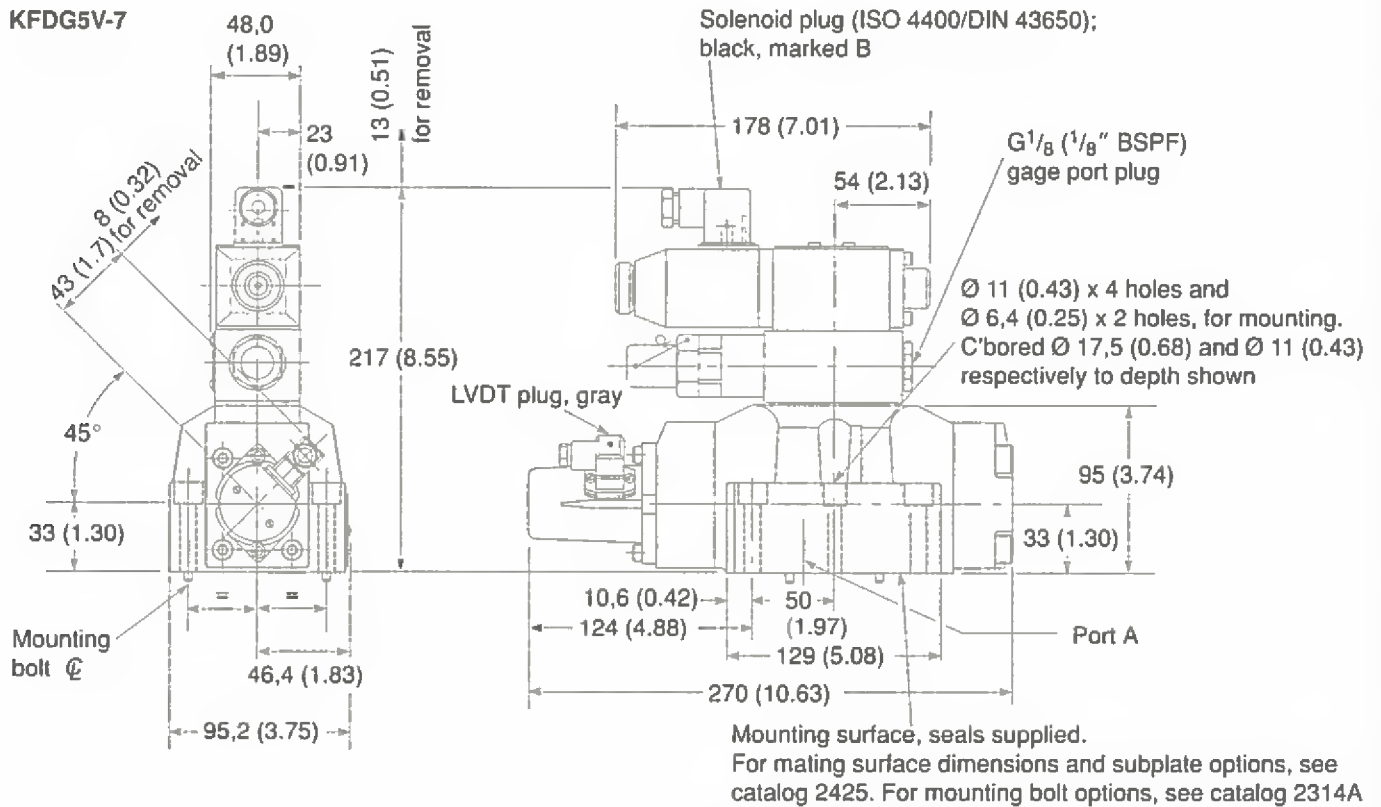
#### Plastic plug 694534

PG11. Cable maximum outside diameter 11,0 (0.43)

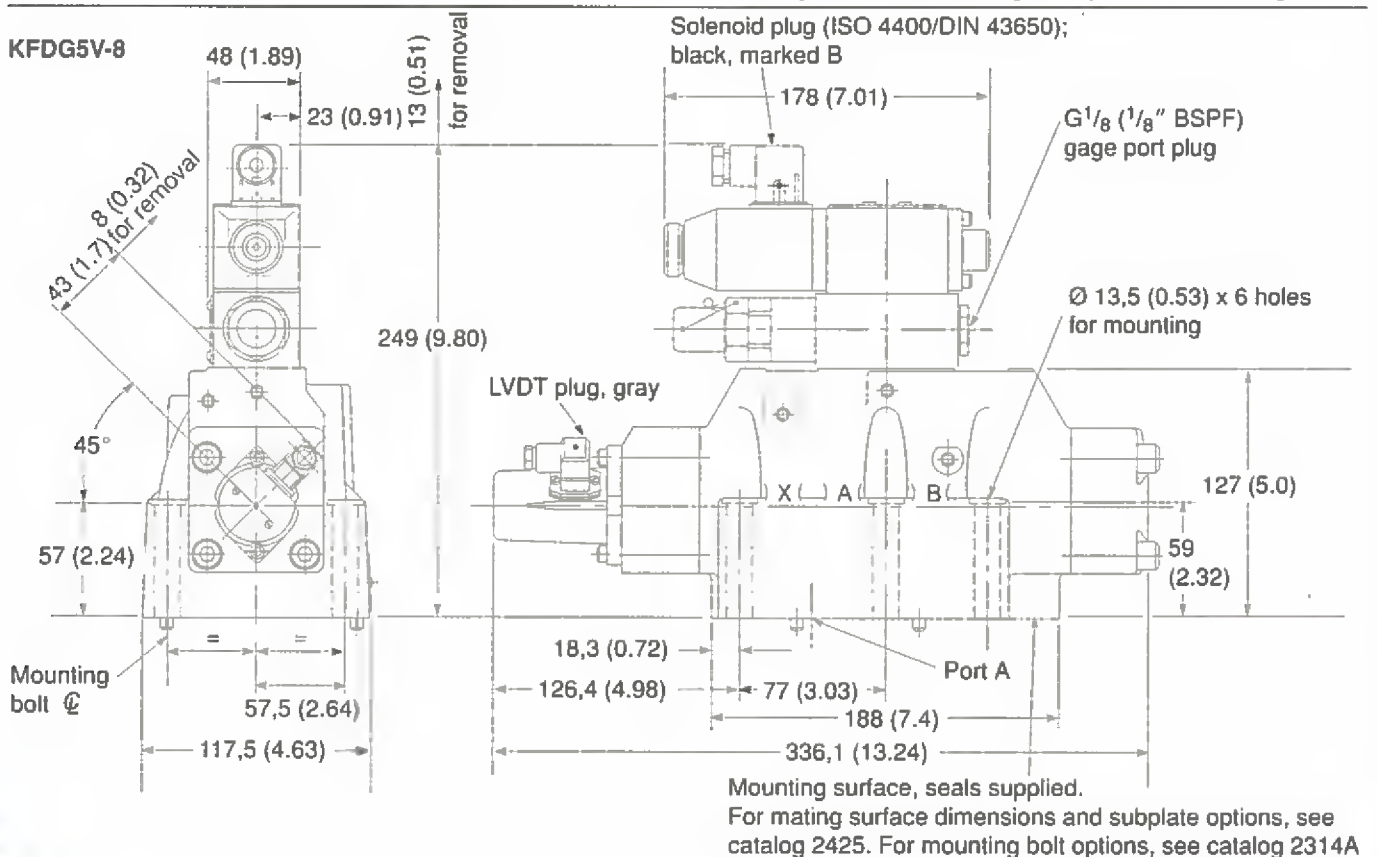
### KFDG5V-5



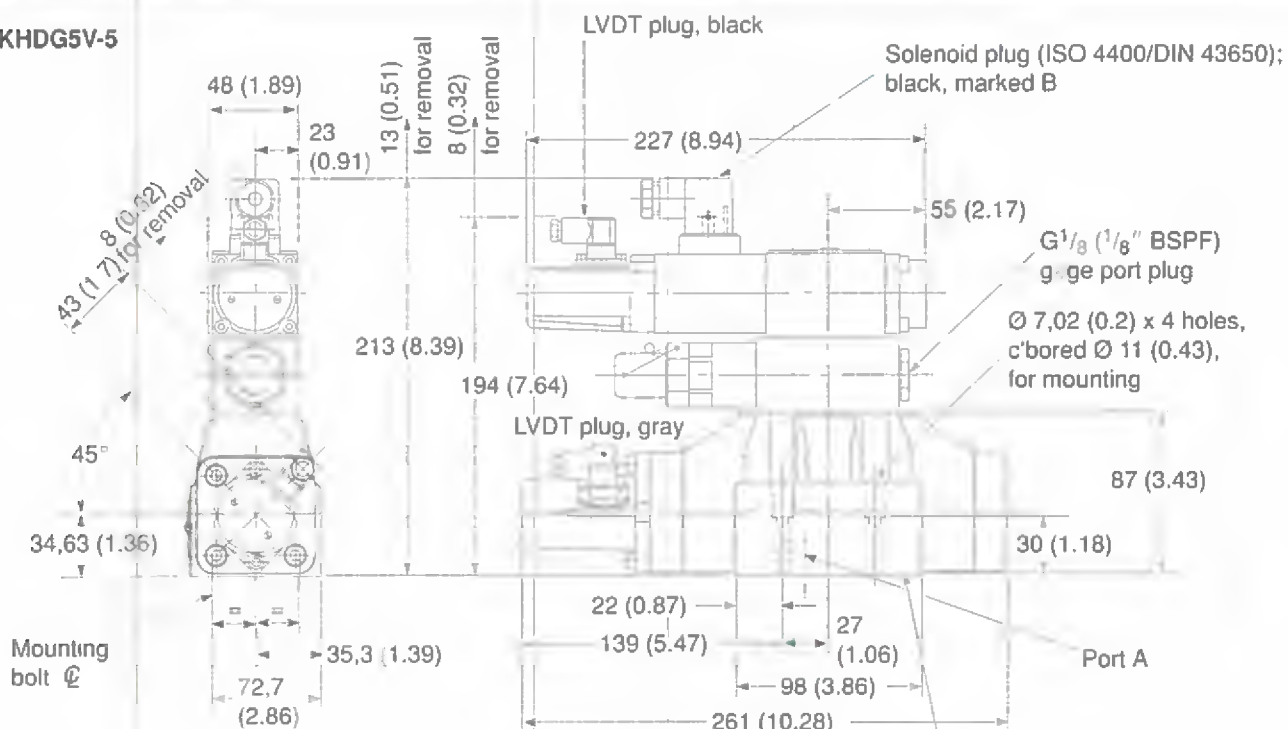
# KFDG5V-7



# KFDG5V-8

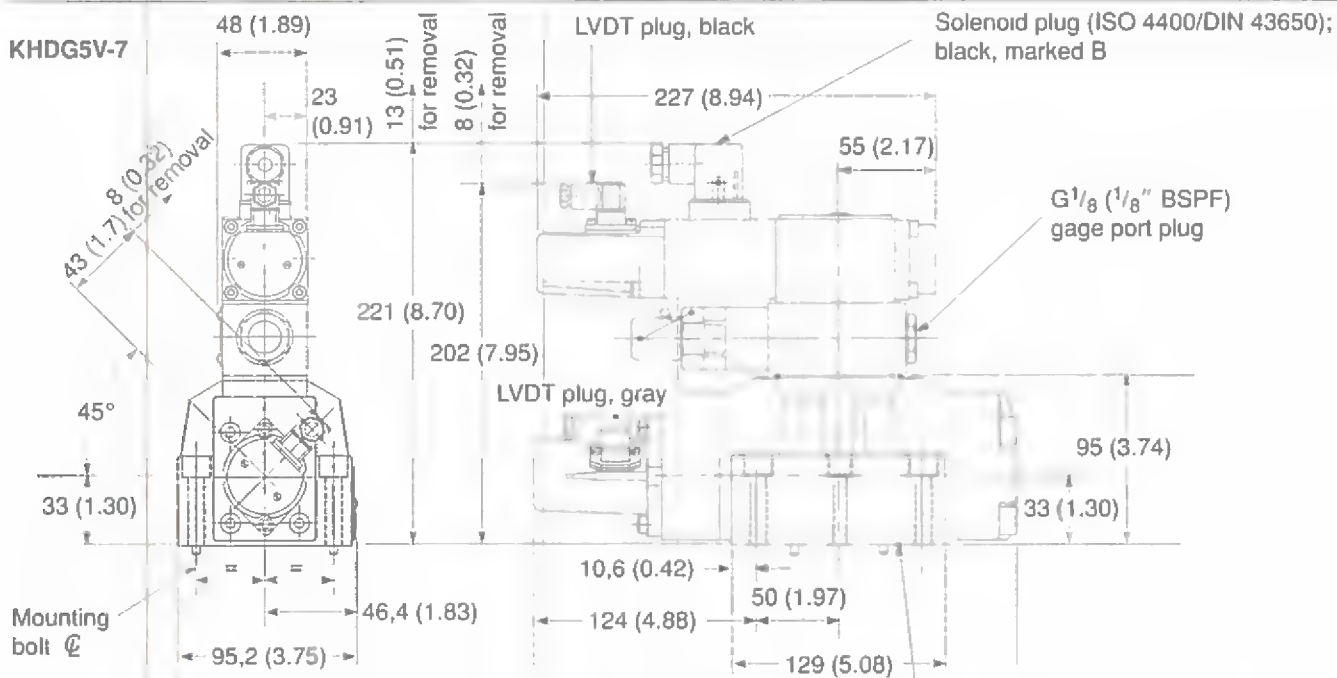


# KHDG5V-5



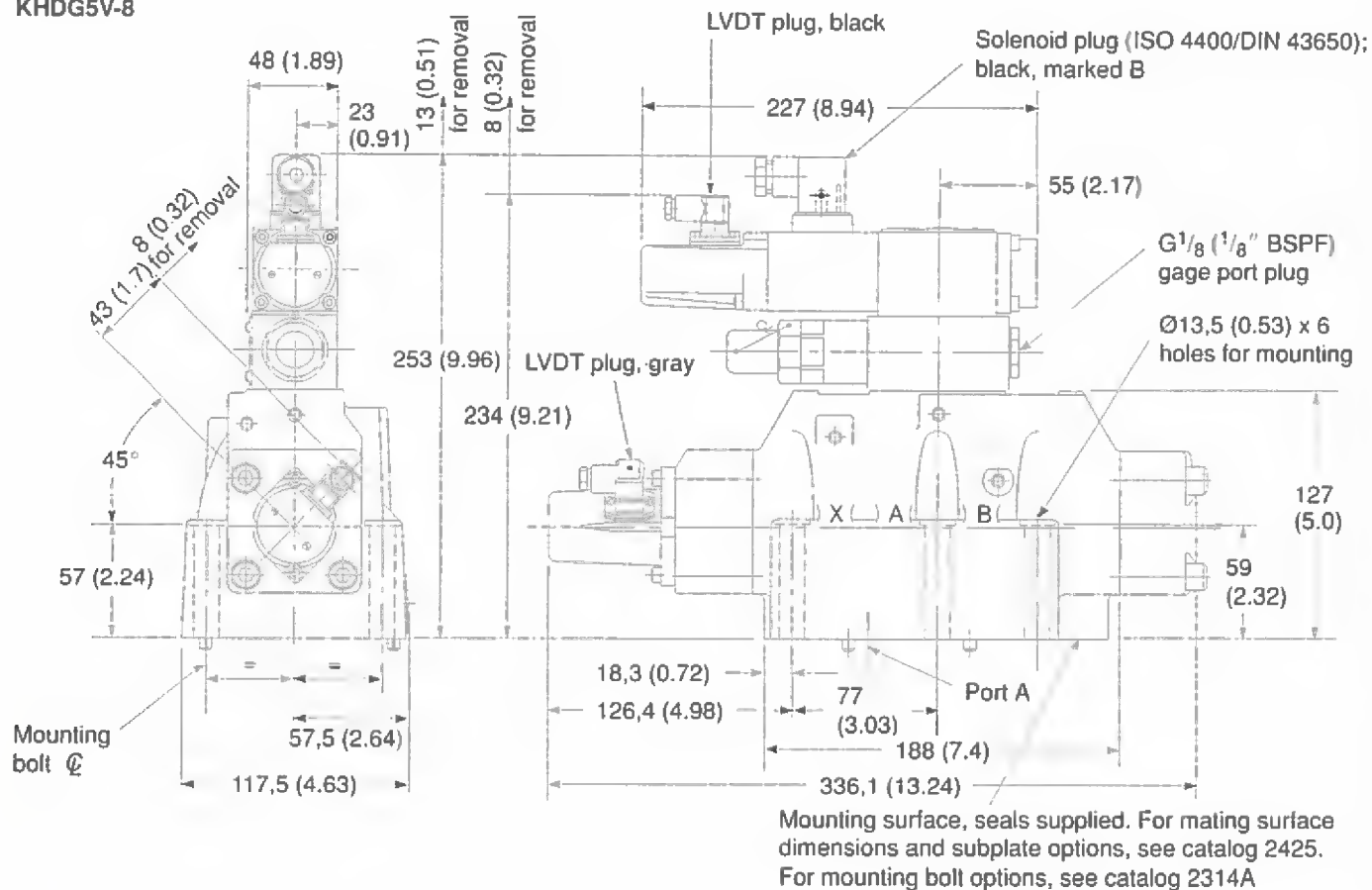
Mounting surface, seals supplied.  
For mating surface dimensions and subplate options, see catalog 2425 (size 05 with additional X and Y ports). For mounting bolt options, see catalog 2314A

# KHDG5V-7



Mounting surface, seals supplied.  
For mating surface dimensions and subplate options, see catalog 2425. For mounting bolt options, see catalog 2314A

## KHDG5V-8

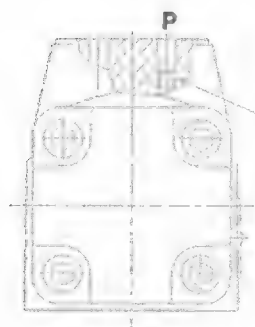


### Pilot-Supply Plug

For K(A)\*DG5V-5 and -8, as below  
For K(A)\*DG5V-7, see cross-section on  
page B.173

### K(A)\*DG5V-5 Valves

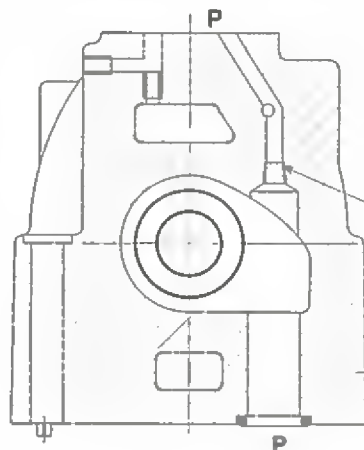
Viewed from port B end of main stage



M5 x 2,5 mm plug  
#471119  
Remove for  
internally piloted  
models

### K(A)\*DG5V-8 Valves

Section through port P of main stage



**1/16" plug  
#113000  
Remove for  
internally piloted  
models**

## Further Information

### Hydraulic Fluids

Materials and seals used in these valves are compatible with:

Anti-wear petroleum oils ..... L-HM

Non-alkyl based

phosphate esters ..... L-HFD

The extreme operating range is 500 to 13 cSt (270 to 70 SUS) but the recommended running range is 54 to 13 cSt (245 to 70 SUS). For further technical information about fluids see Technical Information leaflet B-920 or I-286-S.

### Contamination Control Requirements

Recommendations on contamination control methods and the selection of products to control fluid condition are included in Vickers publication 9132 or 561, "Vicker's Guide to Systemic Contamination Control". The book also includes information on the Vickers concept of "ProActive Maintenance". The following recommendations are based on ISO cleanliness levels at 2 µm, 5 µm and 15 µm.

For products in this catalog the recommended levels are:

Up to 210 bar (3000 psi) ..... 18/16/13

Above 210 bar (3000 psi) ..... 17/15/12

### Installation and Start-up Guidelines

The proportional valves in this catalog can be mounted in any attitude but it may be necessary, in certain demanding applications, to ensure that the solenoids are kept full of hydraulic fluid.

If this proves to be the case any accumulated air can be bled from the solenoid bleed screws. This task is easier if the valve has been mounted base downwards. Good installation practice dictates that the tank port, and any drain port, are piped so as to keep the valve full of fluid once the system start-up has been completed.

### Temperatures

For petroleum oil:

Min. .... -20°C (-4°F)

Max.\* ..... +70°C (158°F)

\* To obtain optimum service life from both fluid and hydraulic system, 65°C (150°F) normally is the maximum temperature.

For other fluids where limits are outside those of petroleum oil, consult fluid manufacturer or Vickers representative. Whatever the actual temperature range, ensure that viscosities stay within those specified under "Hydraulic Fluids".

Ambient for:

Valves, including any feedback transducers and integral amplifiers, at full performance specification:

-20 to +60°C (-4 to +140°F).

Valves, as above, will operate at temperatures of 0 to -20°C (32 to -4°F) but with a reduced dynamic response.

Storage:

-25 to +85°C (-13 to +185°F)

Eurocard electronics:

0 to 50°C (32 to 122°F)

### Seal Kits

K(A)H Pilot ..... 02-138953

KH pilot ..... 565142

KF Pilot ..... 565149

K(A)F/H-5 Mainstage ..... 565143

K(A)F/H-7 Mainstage ..... 565144

K(A)F/H-8 Mainstage ..... 565145



## Proportional Pressure Relief Valves

KCG-3, 1\* Series; KACG-3, 1\* series

### Basic Characteristics

Max. pressure . . . . . 350 bar (5075 psi)  
Max. flow . . . . . 5 L/min (1.3 USgpm)  
Mounting face to ISO 4401 size 03

### General Description

An electro-hydraulic proportional relief valve designed to regulate pressure in a hydraulic system in proportion to an applied electrical input.

These open-loop, single-stage valves can be used for direct control of pressure in low flow systems, or for pilot control of larger pressure controls, and for such applications as pressure-controlled pumps.

#### KCG-3

The valve responds to variations in current supply to its solenoid; separate Vickers amplifiers, with PWM output stage and output current control, are available for driving this model, see "Operating Data".

#### KACG-3

The addition of an integral amplifier allows the pressure to be controlled from a 0 to +10V, or 0 to -10V command signal range. The amplifier is mounted in a robust metal housing and electrical connections are via an industry standard 7-pin plug. Factory-set adjustments ensure high reproducibility valve-to-valve.

#### Other Models

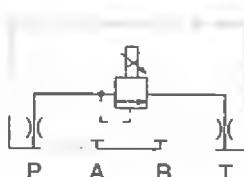
For proportional pressure relief valves with flow ratings up to 400 L/min (106 USgpm), see catalog 2324 (model types KCG, sizes 6 and 8)

### Features and Benefits

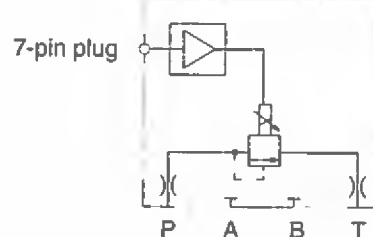
- Valve design ensures low hysteresis and good repeatability.
- Self-bleeding design simplifies installation and ensures consistent performance.
- When used for piloting a large pressure relief or reducing valve, a low minimum pressure is obtainable combined with fast and stable response to step input signals.

### Functional Symbol

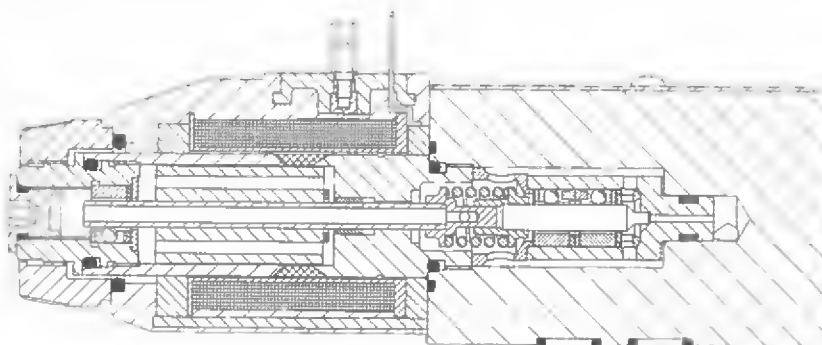
KCG-3




KACG-3



### Typical Section: KCG-3 Valve with Type "U" Coil Connection



This product has been designed and tested to meet specific standards outlined in the European Electromagnetic Compatibility Directive (EMC) 89/336/EEC, amended by 91/263/EEC, 92/31/EEC and 93/68/EEC, article 5. For instructions on installation requirements to achieve effective protection levels, see this leaflet, the Installation Wiring Practices for Vickers Electronic Products leaflet 2468 and leaflet 02-123931A which is packed with every KA valve. Wiring practices relevant to this Directive are indicated by  Electromagnetic Compatibility (EMC).



## Model Code

Features in brackets () may be omitted. All other features must be specified.

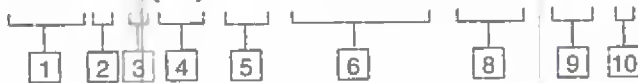
Models requiring separate amplifier

**KCG-3(-L)- \*\*\* -D-Z-M-\*\*\*\*\* - \*\*\* -1\*(-EN46)**



Models with integral amplifier

**KACG-3(-L)- \*\*\* -D-Z-M-2- PD7- H1-1\***



### 1 Valve type

KC = Proportional pressure relief  
KAC = Proportional pressure relief with integral amplifier

### 2 Mounting type

G = Subplate mounted

### 3 Interface

3 = ISO 4401, size 03 (NFFA D03)

### 4 Solenoid location

Blank = At port B end  
L = At port A end

### 5 Controlled pressure range

(All coils except type HJ, see position 9 footnote ▼)

At rated flow of 1 L/min (0.26 USgpm)

40 = 2-40 bar (29-580 psi)  
100 = 3-100 bar (44-1450 psi)  
160 = 4-160 bar (58-2300 psi)  
250 = 5-250 bar (73-3625 psi)  
350 = 6-350 bar (87-5000 psi)

### 6 Standard features

DZM = For KCG-3  
DZM2 = For KACG-3

### 7 Coil connections (KCG only)

U = ISO 4400 (DIN 43650) interface  
FW = Flying-leads in wiring box tapped 1/2" NPT  
FTW = As "FW" plus terminal strip  
FJ = Flying-leads in wiring box tapped M20  
FTJ = As "FJ" plus terminal strip  
P = Plug-in coil (type "H" only)  
Use with "EN46"

### 8 Connections (KACG only)

PD7 = 7 pin connector with plastic plug.  
See Warning note below.

### 9 Coil rating

Code = amps x ohms ▲  
G1 = 3,5 x 1,65  
GP1 = 3,0 x 2,0  
H1 = 1,6 x 7,3 ●  
HA1 = 0,94 x 22  
HJ1 = 1,00 x 14,25 ▼  
HL1 = 0,80 x 29 ◆

▲ Resistance at 20°C (68°F).  
● KACG valves must have H1 coils  
◆ For valves replacing ECG-02 models.  
▼ This low power coil is limited to the following maximum controlled pressures.

Valves supplied with type HJ1 coils will be stamped with the applicable maximum controlled pressure.

Model code position 5	Max. pressure with HJ1 coil
40	35 bar (500 psi)
100	85 bar (1230 psi)
160	140 bar (2000 psi)
250	210 bar (3000 psi)
350	315 bar (4500 psi)

### 10 Design number, 1\* series

Subject to change. Installation dimensions unaltered for design numbers 10 to 19 inclusive.

### 11 Special features

EN46 used with P-type coil connection and Uniplug connector. Omit if not required.



### Warning

To conform to the EC Electromagnetic Compatibility directive (EMC) this KACG valve must be fitted with a metal 7-pin plug. The screen of the cable must be securely connected to the shell of the metal connector. A suitable IP67 rated connector is available from Vickers, part no. 934939. Alternatively a non IP67 rated connector is available from ITT-Cannon, part no. CA 02 COM-E 14S A7 P.

Additionally the cable must be fitted with a ferrite EMC suppression core not more than 4cm from the connector referred to above. Suitable types include Farnell 535-898 or Farnell 535-904 which snap fit over the cable.

The plastic plug, part number 694534, is only suitable for use in a sealed electromagnetic environment or outside of the European Community.

## Operating Data

Standard test conditions are with antiwear hydraulic oil at 36 cSt (168 SUS) and 40°C (104°F)	
Maximum pressures:	
Port P:	
Operating	See [5] in "Model Code"
Static	350 bar (5075 psi)
Port T:	
Operating	2 bar (29 psi). See "Back pressure at port T" under "Installation and start-up" on next page.
Static	210 bar (3000 psi)
Flow limits:	
Rated flow	1 L/min (0.26 USgpm)
Maximum flow	5 L/min (1.3 USgpm)
Coil or amplifier rating:	
KCG models	See [9] in "Model Code"
KACG models	24V x 40W max. (22 to 36V including 10% pk.-to-pk. max. ripple)
Command signal ranges, KACG models	0 to +10V DC, or 0 to -10V DC
Dither, KACG models	Factory set, not user adjustable
Monitor point signal, KACG models	0.5V per amp. solenoid current
Power stage PWM, KACG models	2kHz nominal
7-pin plug connections, KACG models:	
A	Power supply +ve
B	Power 0V
C	Signal 0V
D	+ve voltage command signal
E	-ve voltage command signal
F	Monitor output
G	Protective ground
Electro-magnetic compatibility (EMC)	
KACG models only:	
Emission (10V/m)	EN 50081-2
Immunity (10V/m)	EN 50082-2
Pressure gain	See graph
Factory setting - Maximum with 10V command signal.	
User adjustment - 30 to 120% of factory setting.	
Note that altering this setting will affect valve to valve interchangeability.	
Pressure override	See graph
Minimum-pressure adjustment	50% of maximum pressure limit of model
Pressure step response:	Typical times to reach 90% of commanded step:
KCG-3-250-D-Z-M-*****-H1 model using	
EEA-PAM-513-A-1* amplifier:	
0 to 100% step	48 ms
100 to 0% step	9 ms
25 to 100% step	37 ms
100 to 25% step	18 ms
KACG-3-250 model:	
0 to 100% step	40 ms
100 to 0% step	18 ms
25 to 100% step	26 ms
100 to 25% step	30 ms
Linearity, between 10% and 100% of controlled pressure range	<4%

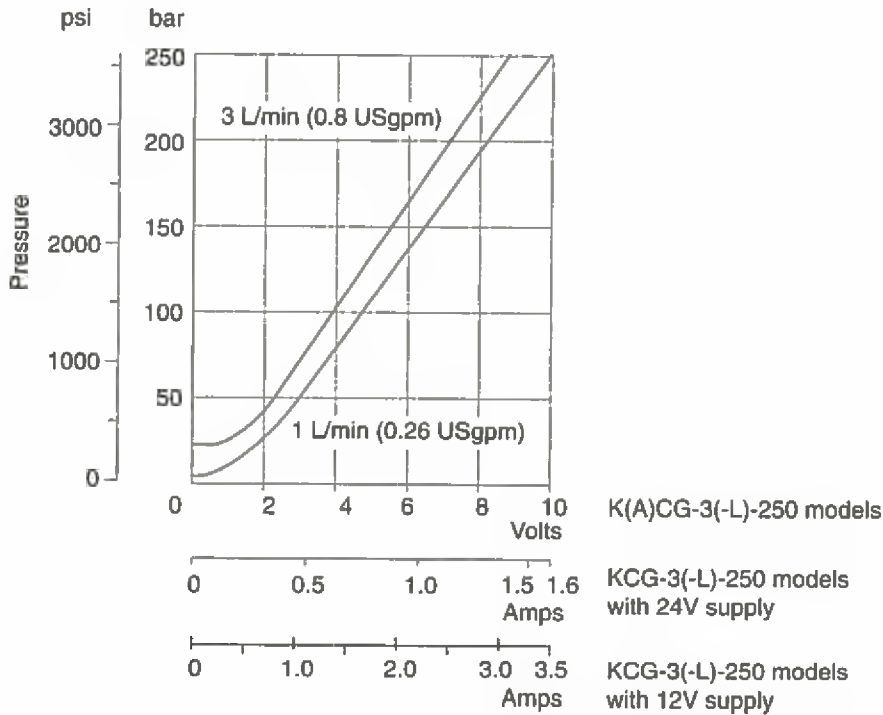
Hysteresis KCG models KACG models	<4% (with 100 mA pk.-to-pk. dither) <5% (with factory-set dither)
Repeatability KCG models KACG models	<± 0,5% of rated pressure for a constant coil current <± 1.0% of rated pressure for a constant amplifier supply voltage and constant command signal
Reproducibility (valve to valve) KACG models only	<3% at factory settings
Protection, Electrical (KACG models)	Reverse-polarity protected
Mass (weight) KCG KACG	1,7 kg (3.8 lb) 2,1 kg (4.6 lb)
Supporting products: Amplifiers for KCG valves with "H" type coils only: EHH-AMP-724-C/D-10 (Uniplug) EHH-AMP-7*2 series (power plug) EEA-PAM-513-A-14 (1 adjustable ramp) EEA-PAM-513-A-3* (2 adjustable ramps) Auxilliary electronic modules (Din-rail mounting) for KACG models: EHA CON 201 A 2* signal converter EHD DSG 201 A 1* command signal generator EHA RMP 201 A 2* ramp generator EHA PID 201 A 2* PID controller EHA PSU 201 A 1* power supply ISO 4400 (DIN 43650) electrical connector: Black, marked "B" Gray, marked "A" Subplates, size 03 Mounting bolts ■ ■ <i>Note: If not using Vickers recommended bolt kits, bolts must be to ISO 898 grade 12.9 or stronger.</i>	See catalog 2367 See catalogs 2114, 2115 and 2282 See catalog 2137 See catalog 2464  See catalog 2410B See catalog 2470 See catalog 2410B See catalog 2427 See catalog 2410B  Part number 710775 Part number 710776 See catalog 2425 See catalog 2314A
Installation and start-up (commissioning): Installation and start-up (commissioning) guide  Electrical data Electromagnetic capability Mounting attitude  Back pressure at port T	ML-B-9133B (Multi-lingual English, German, French and Italian), shipped with each product and also available separately on request. See under that heading on previous page. See under that heading on previous page. No restriction, provided that the valve is kept full of fluid through port T. Port T should be piped directly to reservoir with minimum restriction. Any back pressure at this port is additive to the controlled pressure at port P. The recommended max. pressure at port T when the valve is controlling pressure is 2 bar (29 psi); the max. pressure at T under static conditions is 210 bar (3000 psi).
Ordering procedure	Valves, subplates, bolt kits and Vickers amplifiers should be ordered by full model code designation. Order ISO (DIN) electrical connectors by part number.

# Performance Data

## Pressure Gain, Typical

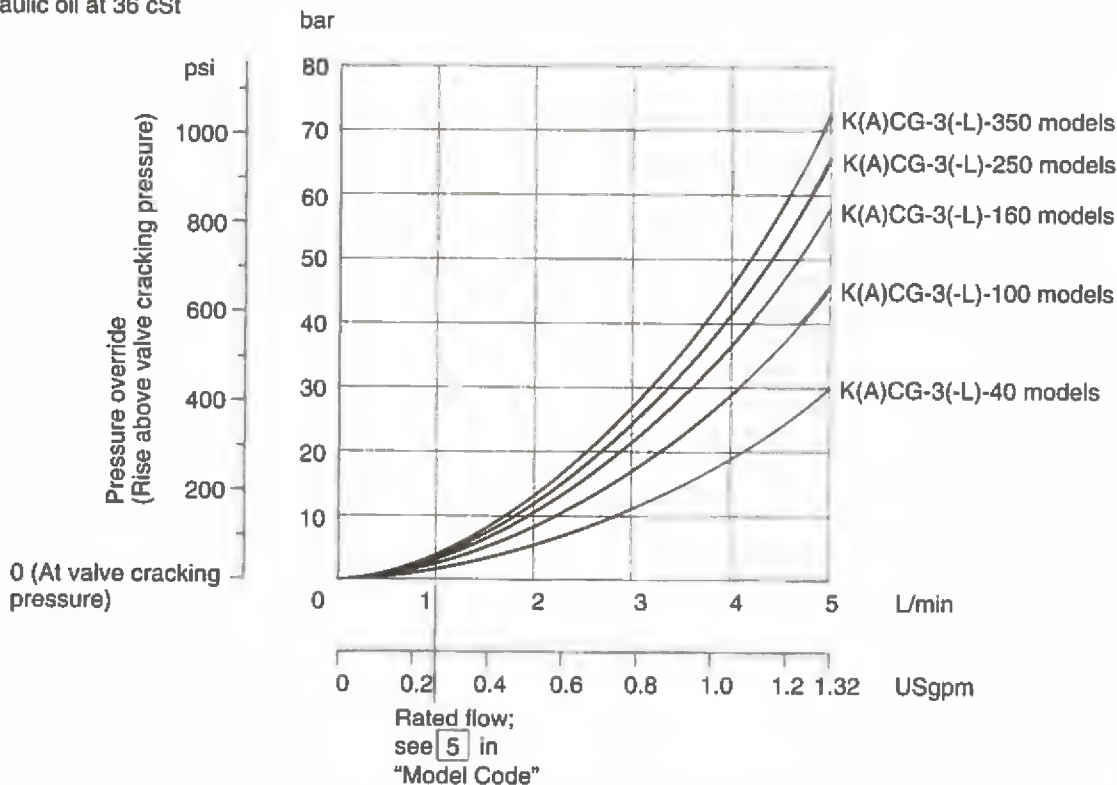
Typical pressure v. command signal response of K(A)CG-3-250 models

Test conditions:  
Fluid = Antiwear hydraulic oil at 36 cSt (168 SUS)



## Pressure Override, Typical

Test conditions:  
Fluid = Antiwear hydraulic oil at 36 cSt (168 SUS)



# KACG-3 Electrical Block Diagram

## Wiring

Connections must be made via the 7-pin plug mounted on the amplifier.

Recommended cable sizes are:

### Power cables:

For 24V supply

0,75 mm<sup>2</sup> (18 AWG) up to 20m (65 ft)

1,00 mm<sup>2</sup> (17 AWG) up to 40m (130 ft)

### Signal cables:

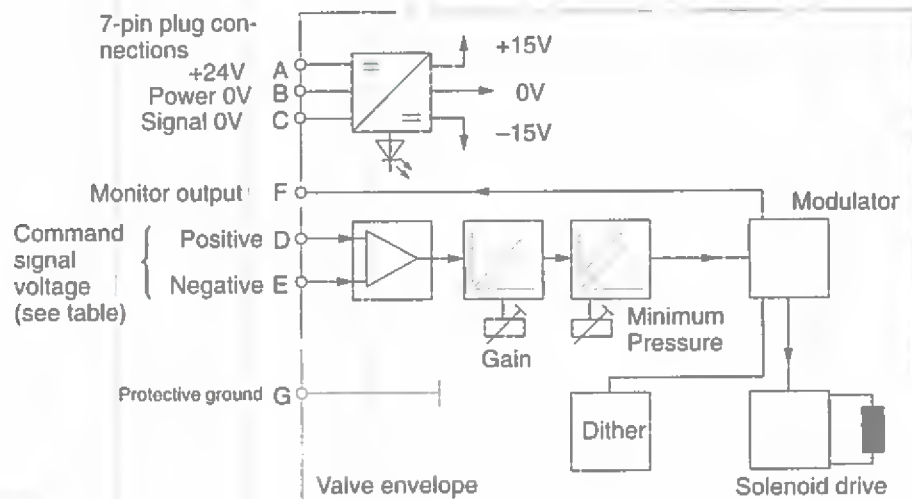
0,50 mm<sup>2</sup> (20 AWG)

### Screen:

A suitable cable would have 7 cores, a separate screen for the signal wires and an overall screen.

See wiring connection diagram on page

B.195

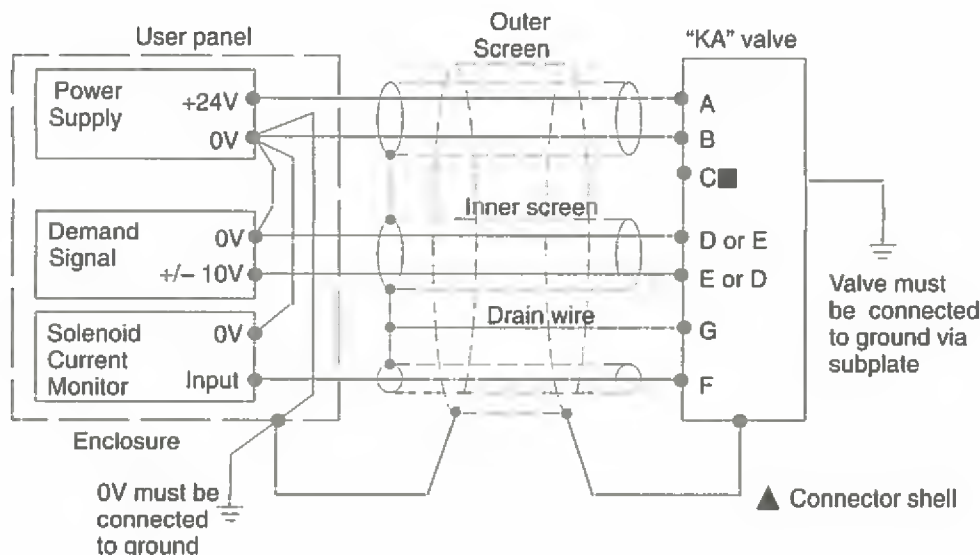


### Warning

All power must be switched off before connecting or disconnecting any plugs.

# KACG-3 Typical Connection Arrangements

## Wiring Connections for Valves with Integral Amplifier



■ Solenoid current monitor voltage (pin F) will be referenced to the KA valve local ground. A "local ground" (pin C) is provided for optional use by differential input customer supplied electronics.

▲ Note: In applications where the valve must conform to European RFI/EMC regulations, the outer screen (shield) must be connected to the outer shell of the 7-pin connector and the valve body must be fastened to the earth ground. Proper earth grounding practices must be observed in this case, as any differences in command source and valve ground potentials will result in a screen (shield) ground loop.



### Warning

Do not ground pin C. If the local ground (pin C) is not used for differential monitor electronics, do not use. Read monitor pin F with respect to ground.



### Warning

Electromagnetic Compatibility (EMC)

It is necessary to ensure that the valve is wired-up as above. For effective protection, the user electrical cabinet, the valve subplate or manifold, and the cable screens should be connected to efficient ground points. The metal 7-point connector, part no. 934939, should be used for the integral amplifier.

In all cases, both valve and cable should be kept as far as possible from any sources of electromagnetic radiation such as cables carrying heavy current, relays and certain kinds of portable radio transmitters, etc. Difficult environments could mean that extra screening may be necessary to avoid the interference.

It is important to connect the 0V lines as shown above. The multi-core cable should have at least two screens to separate the demand signal and monitor output from the power lines.

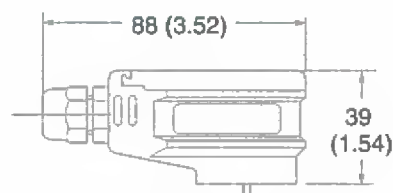


## Installation Dimensions in mm (inches)

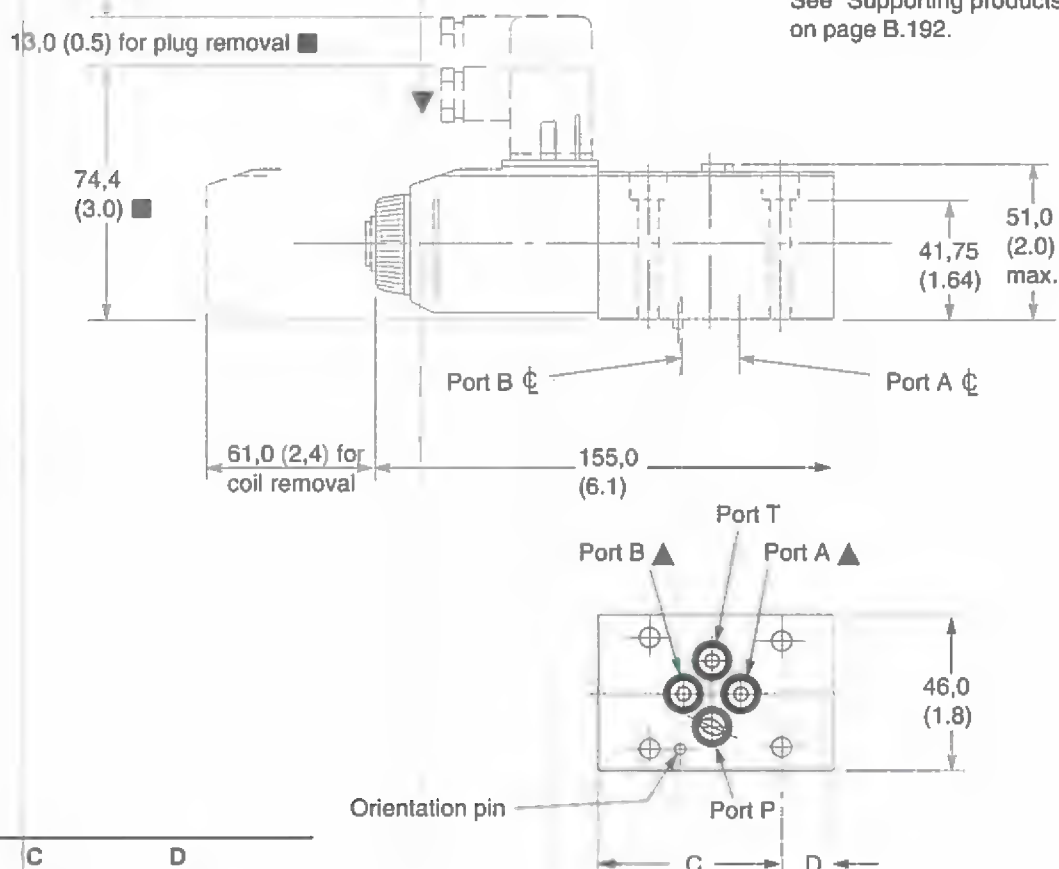
### KCG-3-\*\*\*-D-Z-M-U-10 models

For KCG-3-L-\*\*\*-D-Z-M-U models the solenoid is mounted at port A-end of body, which then has C and D dimensions as in table.

3rd angle projection 



**Alternative Power Plugs**  
See "Supporting products" on page B.192.



Model	C	D
KCG-3-***	57,3 (2.26)	20,5 (0.81)
KCG-3-L-***	61,2 (2.41)	16,8 (0.66)

■ KCG-3-(L)-\*\*\*-D-Z-M-U models.

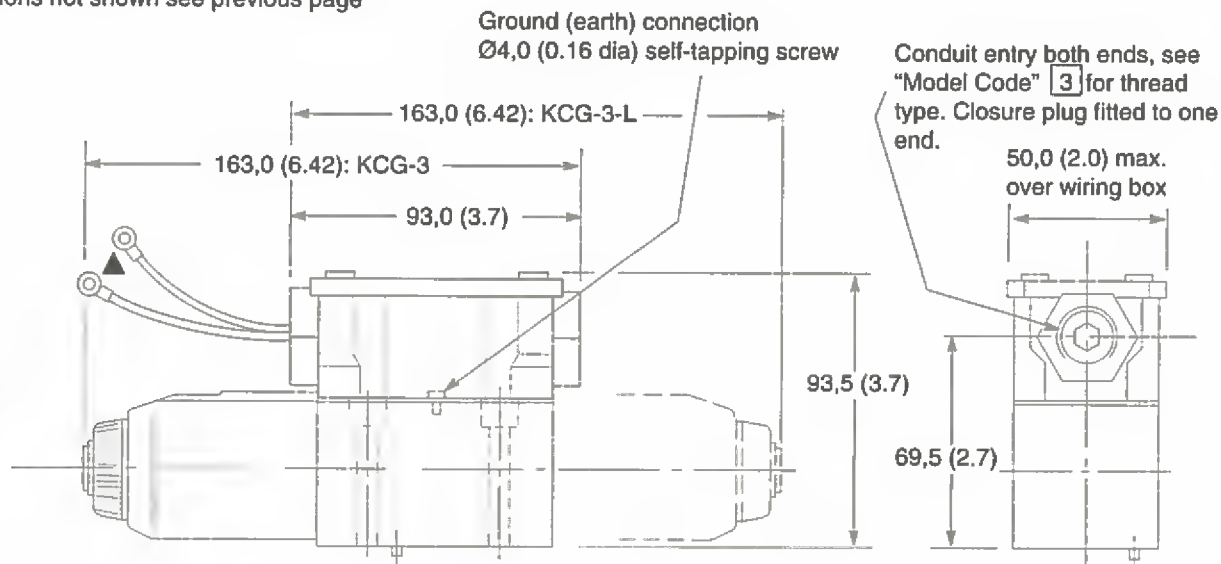
Dimensions may vary according to source of plug.

▲ Ports A and B are blind holes with O-ring recesses.

▼ The cable entry on this plug can be repositioned at 90° intervals by reassembly of the contact holder relative to the plug housing. The cable entry is Pg 11 for cables Ø6-10 mm (0.24-0.4" dia).

### KCG-3-(L)-\*\*\*-D-Z-M-F\*\*\*1-10 models

For dimensions not shown see previous page



#### ▲ Ref. Model Code **7** :

Codes "FJ" and "FW": 2 lead wires approx. 150,0 (6.0) long.  
M3 terminals provided for customer connection.  
Codes "FTJ" and "FTW": Lead wires connected into terminal strip suitable for M3 terminals on customer connection.

### KCG-3-(L)-\*\*\*-D-Z-M-P-H1-10-EN46

For use with Vickers single-cable UNIPLUG connectors:

**For "Soft Switch" Control:**

Use UNIPLUG model type EHH-AMP-724-C\*\*-1\*

**For Proportional Control:**

Use UNIPLUG model type EHH-AMP-724-D\*\*-1\*

UNIPLUG connectors should be ordered separately;  
see catalog 2367.

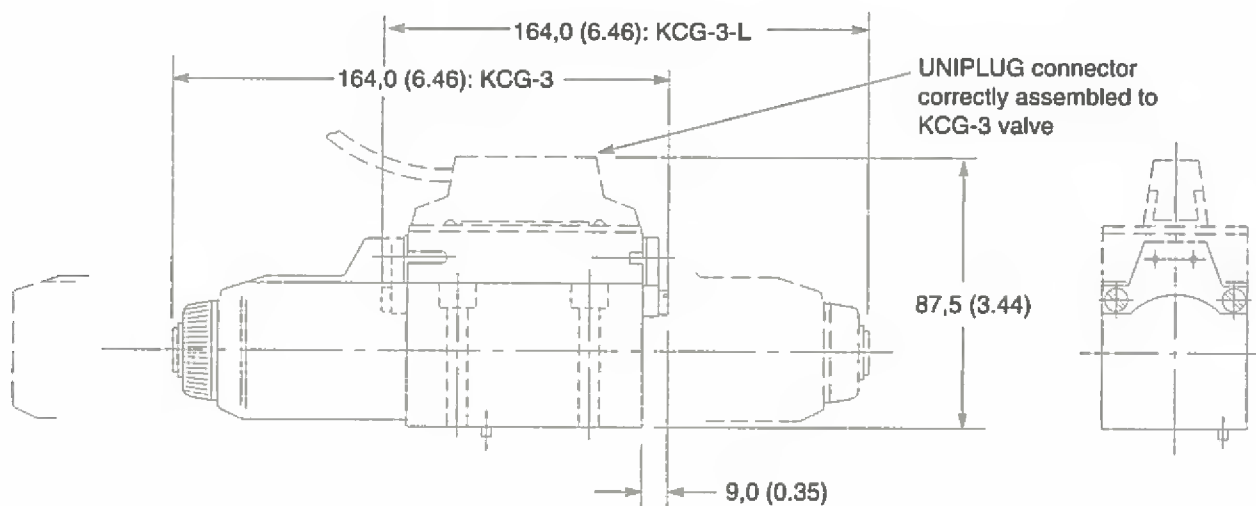
To fit UNIPLUG connector to KCG-3 valve:

Unscrew coil retention nut and remove coil.

Slide UNIPLUG connector onto dummy pins (at non-solenoid end) then replace coil, ensuring pins are fully engaged.

Replace and tighten coil retention nut.

For dimensions not shown see previous page.



### KACG-3-\*\* models

For KACG-3-L-\*\*\* models the solenoid is mounted at port A-end of body (both versions have C and D dimensions as in table on page B.196 ) and the amplifier turned through 180°

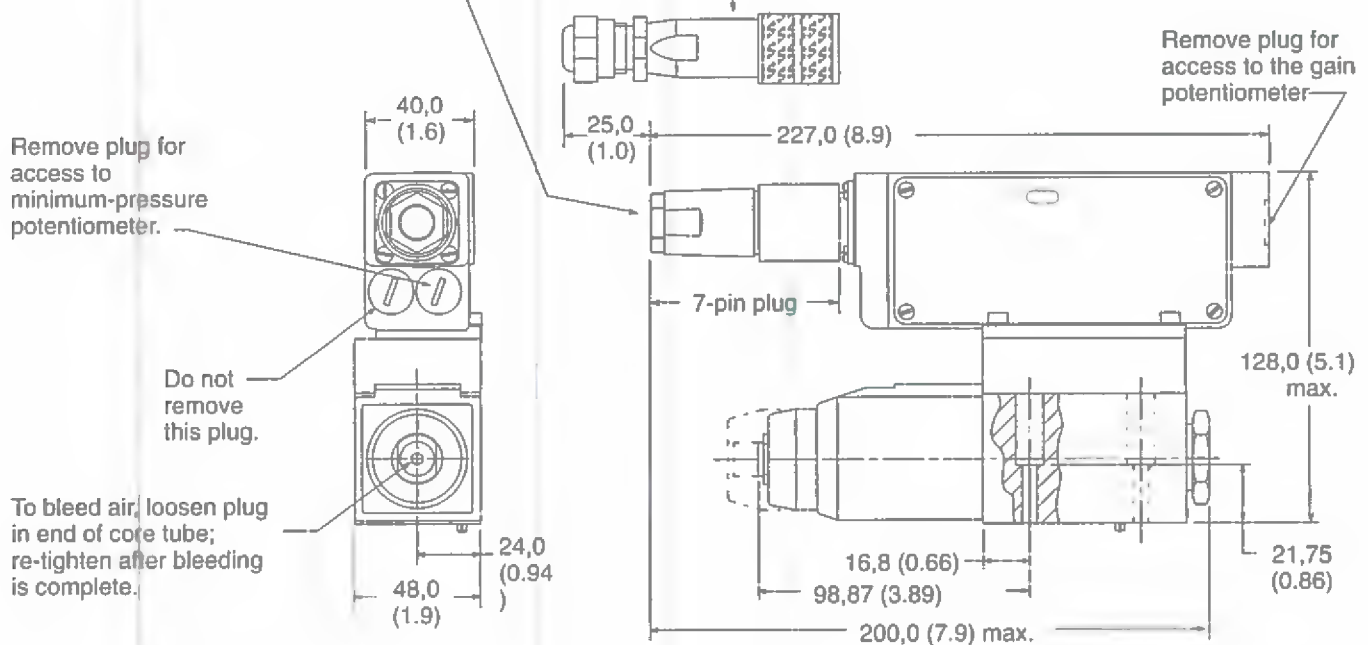
#### Metal plug 934939

Cable outside diameter 8,0 to 10,5 (0.31 to 0.41)

Must be used for full EMC protection. See also warning note on page B.190

#### Plastic plug 694534

PG11. Cable maximum outside diameter 11,0 (0.43)



See **Warning** note on page B.190 regarding the use of 7-pin plugs.

## Further Information

### Hydraulic Fluids

Materials and seals used in these valves are compatible with:

Anti-wear petroleum oils ..... L-HM

Non-alkyl based

phosphate esters ..... L-HFD

The extreme operating range is 500 to 13 cSt (270 to 70 SUS) but the recommended running range is 54 to 13 cSt (245 to 70 SUS). For further technical information about fluids see Technical Information leaflet B-920 or I-286-S.

### Contamination Control Requirements

Recommendations on contamination control methods and the selection of products to control fluid condition are included in Vickers publication 9132 or 561, "Vickers Guide to Systemic Contamination Control". The book also includes information on the Vickers concept of "ProActive Maintenance".

The following recommendations are based on ISO cleanliness levels at 2 µm, 5 µm and 15 µm.

For products in this catalog the recommended levels are:

Up to 210 bar (3000 psi) ..... 18/16/13

Above 210 bar (3000 psi) ..... 17/15/12

### Installation and Start-up Guidelines

The proportional valves in this catalog can be mounted in any attitude but it may be necessary, in certain demanding applications, to ensure that the solenoids are kept full of hydraulic fluid.

If this proves to be the case any accumulated air can be bled from the solenoid bleed screw. This task is easier if the valve has been mounted base downwards. Good installation practice dictates that the tank port, and any drain port, are piped so as to keep the valve full of fluid once the system start-up has been completed.

### Temperatures

For petroleum oil:

Min. .... -20°C (-4°F)

Max.\* ..... +70°C (158°F)

\* To obtain optimum service life from both fluid and hydraulic system, 65°C (150°F) normally is the maximum temperature.

For other fluids where limits are outside those of petroleum oil, consult fluid manufacturer or Vickers representative. Whatever the actual temperature range, ensure that viscosities stay within those specified under "Hydraulic Fluids".

Ambient for:

Valves at full performance specification: -20 to +60°C (-4 to +140°F).

Valves, as above, will operate at temperatures of 0 to -20°C (32 to -4°F) but with a reduced dynamic response.

Storage:

-25 to +85°C (-13 to +185°F)

Eurocard electronics:

0 to 50°C (32 to 122°F)

### Seal Kits

K(A)CG-3 (KA + DIN) ..... 02-138201

KCG-3 ('F' & 'P' versions) .. 02-145869

## Proportional Pressure Relief Valves

### K(A)CG-6/8, 1\* Series

#### Basic Characteristics

Max. pressure . . . . . 350 bar (5000 psi)  
 Max. flow rate . . . 400 L/min (106 USgpm)  
 Mounting face to ISO 6264:  
 For K(A)CG-6 . . . . . AR-06-2-A  
 For K(A)CG-8 . . . . . AS-08-2-A

#### General Description

These two-stage pressure relief valves (based on Vickers type CG2V valves featured in catalog 2323) offer extensive application possibilities through their ability to control the pressure setting in proportion to an applied electrical input (up to a pressure limit which is manually adjustable and lockable).

Two model types are available

##### KCG-6/8

The valve responds to variations of current input to its solenoid, for which separate Vickers drive amplifiers, with PWM output stage and output current control, are available.

The proportional pilot control stage is a Vickers type KCG-3 valve, described in catalog 2162.

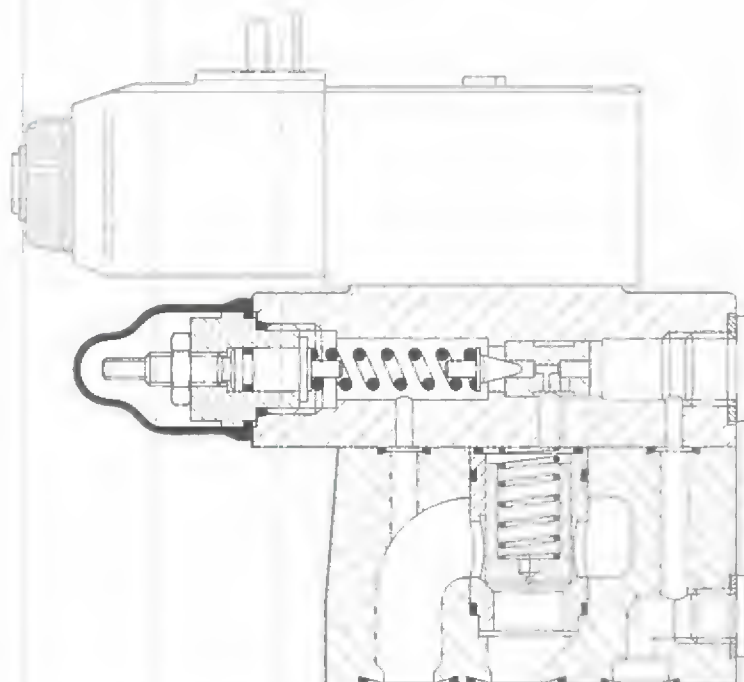
##### KACG-3


The addition of an integral amplifier allows the pressure to be controlled from a 0 to +10V, or 0 to -10V command signal range. The amplifier is mounted in a robust metal housing and electrical connections are via an industry standard 7-pin plug. Factory-set adjustments ensure high reproducibility valve-to-valve.

#### Features and Benefits

- With or without integrated electronics.
- Remote electrical proportional control of pressure from a choice of five pressure ranges per valve size.
- Excellent repeatability and stable performance results from cartridge design of mainstage elements.
- Low installed cost and space requirement from high power/size ratios (more than double that of many conventional designs).

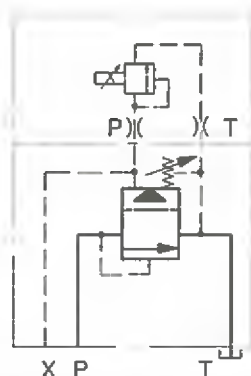
KCG-6 Valve with Type "U" Coil Connection



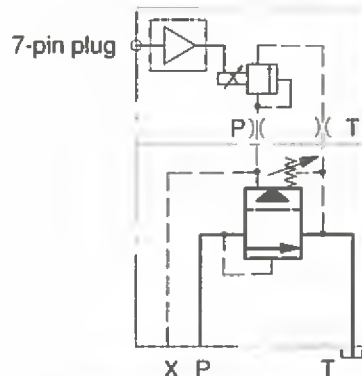
*This product has been designed and tested to meet specific standards outlined in the European Electromagnetic Compatibility Directive (EMC) 89/336/EEC, amended by 91/263/EEC, 92/31/EEC and 93/68/EEC, article 5. For instructions on installation requirements to achieve effective protection levels, see this leaflet, the Installation Wiring Practices for Vickers Electronic Products leaflet 2468 and leaflet 02-123931A which is packed with every KA valve. Wiring practices relevant to this Directive are indicated by  Electromagnetic Compatibility (EMC).*

## Functional Symbols

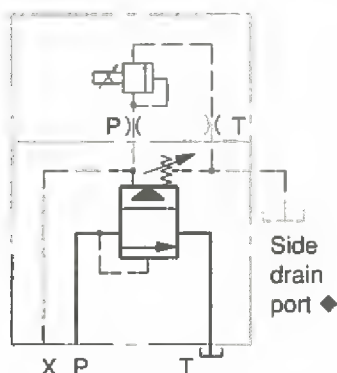
KCG-6/8 with manual and electrical  
pilots internally drained to port T:  
Model code **5** = Blank



KACG-6/8 with manual and electrical  
pilots internally drained to port T:  
Model code **5** = Blank

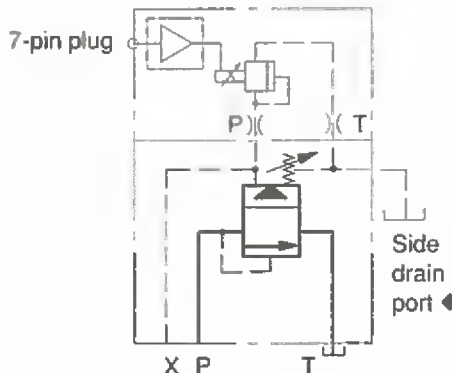


KCG-6/8 with manual and electrical  
pilots drained to side drain port **◆**:  
Model code **5** = 1



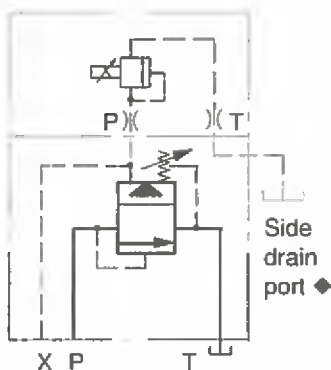
◆ Tapped port on side of pilot head.

KACG-6/8 with manual and electrical  
pilots drained to side drain port **◆**:  
Model code **5** = 1



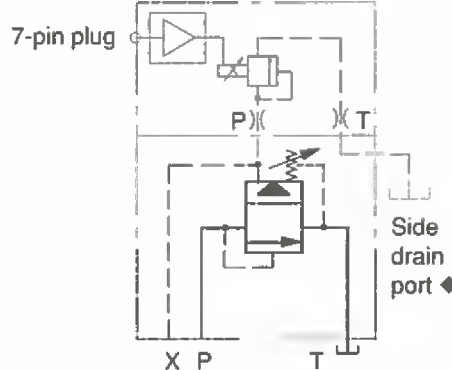
◆ Tapped port on side of pilot head.

KCG-6/8 with manual pilot internally  
drained to port T; electrical pilot  
drained to side drain port **◆**:  
Model code **5** = 3



◆ Tapped port on side of pilot head.

KACG-6/8 with manual pilot  
internally drained to port T; electrical  
pilot drained to side drain port **◆**:  
Model code **5** = 3



◆ Tapped port on side of pilot head.



## Model Code

Features in brackets ( ) may be omitted. All other features must be specified.

Models requiring separate amplifiers

**(F3-)KCG- \* - \* \*\*\* -\*- Z-M- \*\*\* - \*\*\* -1\*(-EN46)**



Models with integral amplifier

**(F3-)KACG- \* - \* \*\*\* -\*- Z-M-PD7- H1 -1\***



### 1 Fluid compatibility

Blank = Antiwear hydraulic oil  
(class L-HM)  
F3 = As above or phosphate ester  
(class L-HFD)

### 2 Valve type

KC = Proportional pressure relief  
KAC = Proportional pressure relief  
with integral amplifier

### 3 Mounting type

G = Subplate mounted

### 4 Mounting surface, ISO 6264

6 = AR-06-2-A  
8 = AS-08-2-A

### 5 Type of manual adjustment

K = Micrometer with keylock  
M = Micrometer without keylock  
W = Screw/locknut

### 6 Pressure adjustment control range

(All coils except type HJ, see position 11, footnote ■)  
40 = 6 - 40 bar (87 - 580 psi)  
100 = 7,75 - 100 bar (112 - 1450 psi)  
160 = 8,5 - 160 bar (125 - 2300 psi)  
250 = 8,5 - 250 bar (125 - 3600 psi)  
350 = 9,0 - 350 bar (130 - 5000 psi)

### 7 Pilot drain options

See also "Functional Symbols"

Code	Drain routing: Manual pilot stage	Electrical pilot stage
Blank	Port T	Port T
1	Side port	Side port
3	Port T	Side port

### 8 Standard features

Z-M = For KCG-6/8 and KACG-6/8

### 9 Coil connection type (KCG only)

U = ISO 4400 (DIN43650)  
interface▼  
FW = Flying-leads in wiring box  
tapped 1/2" NPT  
FTW = As "FW" plus terminal strip  
FJ = Flying-leads in wiring box  
tapped M20  
FTJ = As "FJ" plus terminal strip  
P = Plug-in coil (type "H" only)  
Use with "EN46"

▼ Female connector to be supplied  
by user.

### 10 Connections (KACG only)

PD7 = 7 pin connector with plastic  
plug.  
See Warning note regarding CE  
compliance on page B.225

### 11 Coil rating

Code = amps x ohms ◆  
G1 = 3,5 x 1,65  
GP1 = 3,0 x 2,0  
H1 = 1,6 x 7,3▼  
HA1 = 0,94 x 22  
HJ1 = 1,0 x 14,25■  
HL1 = 0,80 x 29●  
◆ Resistance at 20° C (68° F).  
▼ KACG valves must have H1 coils  
1 For valves replacing CGEV models.  
■ This lower power coil is limited to  
the following maximum controlled  
pressures. Valves supplied with type  
HJ coils will be stamped with the  
applicable maximum controlled  
pressure.

Model code position 6	Max. pressure with HJ coil
40	35 bar (500 psi)
100	85 bar (1100 psi)
160	140 bar (2000 psi)
250	210 bar (3000 psi)
350	315 bar (4500 psi)

### 12 Design number, 1\* series

Subject to change. Installation  
dimensions unaltered for design  
numbers 10 to 19 inclusive.

### 13 Special features

EN46 used with P-type coil connection  
and Uniplug connector.  
Omit if not required.

## Operating Data

Standard test conditions are with antiwear hydraulic oil at 36 cSt (168 SUS) and 50°C (122°F)

<b>Maximum pressures:</b> Ports P and X ▲ Port T ▲ in K(A)CG-*-*-*-Z- valves Port T ▲ in K(A)CG-*-*-*-1/3-Z- valves Side drain port ▲ <i>s Back pressure at these ports additive to the pressure setting of the valve.</i>	350 bar (5000 psi) 2 bar (30 psi) 350 bar (5000 psi) 2 bar (30 psi)
<b>Rated flow at <math>\Delta p = 6</math> bar (87 psi):</b> K(A)CG-6 K(A)CG-8	200 L/min (52.8 USgpm) 400 L/min (105.7 USgpm)
<b>Vent ♦ flow with valve at rated flow</b> ♦ See "Venting", page B.205.	1 L/min (0.26 USgpm)
<b>Pilot control drain flow, when valve is limiting system pressure, i.e. flow P to T occurring:</b> K(A)CG-6 K(A)CG-8	1,3 L/min (0.34 USgpm) 2,0 L/min (0.53 USgpm)
<b>Coil or amplifier rating:</b> KCG models KACG models	See <a href="#">11</a> in "Model Code" 24V x 40W max. (22 to 36V including 10% pk. to pk. max. ripple)
<b>Command signal ranges, KACG models</b>	0 to +10V DC, or 0 to -10V DC
<b>Dither, KACG models</b>	Factory set, not user adjustable
<b>Monitor point signal, KACG models</b>	0,5V per amp. solenoid current
<b>Power stage PWM, KACG models</b>	2kHz nominal
<b>7-pin plug connections, KACG models:</b> A B C D E F G	Power supply +ve Power 0V Signal 0V +ve voltage command signal -ve voltage command signal Monitor output Protective ground
<b>Electro-magnetic compatibility (EMC)</b> KACG models only: Emission (10V/m) Immunity (10V/m)	EN 50081-2 EN 50082-2
<b>Pressure gain, KACG models</b> Factory setting - Maximum with 10V command signal. User adjustment - 30 to 120% of factory setting. Note that altering this setting will affect valve to valve interchangeability.	See graph
<b>Pressure override when relieving and when off-load</b>	See graphs
<b>Hysteresis</b> KCG models KACG models	<5% (with 100 mA pk.-to-pk. dither) <6% (with factory-set dither)
<b>Linearity, between 10% and 100% of rated pressure:</b> K(A)CG-6 models at 100 L/min (26 USgpm) K(A)CG-8 models at 200 L/min (52 USgpm)	<6% <6%

## Operating Data

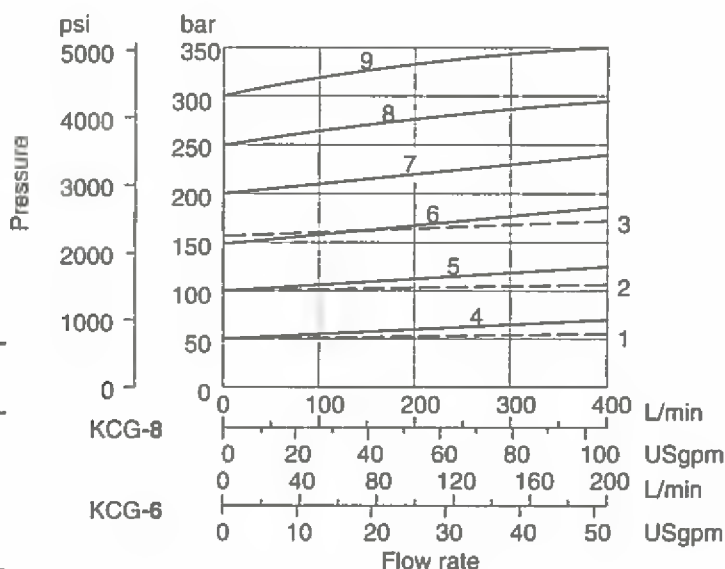
Repeatability	<1,3% of rated pressure
Protection, Electrical (KACG models)	Reverse-polarity protected
Mass (weight)	
KCG-6	4,9 kg (10.8 lb)
KACG-6	5,3 kg (11.7 lb)
KCG-8	5,8 kg (12.8 lb)
KACG-8	6,2 kg (13.7 lb)
Supporting products:	
Amplifiers for KCG valves with "H" type coils only:	
EHH-AMP-724-C/D-10 (Uniplug)	See catalog 2367
EHH-AMP-7*2 series (power plug)	See catalogs 2114, 2115 and 2282
EEA-PAM-513-A-14 (1 adjustable ramp)	See catalog 2137
EEA-PAM-513-A-3* (2 adjustable ramps)	See catalog 2464
Auxiliary electronic modules (Din-rail mounting) for KACG models:	
EHA CON 201 A 2* signal converter	See catalog 2410B
EHD DSG 201 A 1* command signal generator	See catalog 2470
EHA RMP 201 A 2* ramp generator	See catalog 2410B
EHA PID 201 A 2* PID controller	See catalog 2427
EHA PSU 201 A 1* power supply	See catalog 2410B
ISO 4400 (DIN 43650) electrical connector:	
Black, marked "B"	Part number 710775
Gray, marked "A"	Part number 710776
Subplates, size 03	See catalog 2425
Mounting bolts ■	See catalog 2314A
■ <i>Note: If not using Vickers recommended bolt kits, bolts must be to ISO 898 grade 12.9 or stronger.</i>	
Installation and start-up (commissioning):	
Installation and start-up (commissioning) guide	ML-B-9133B (Multi-lingual English, German, French and Italian), shipped with each product and also available separately on request.
Mounting attitude	No restriction, provided that the valve is kept full of fluid through port T.
Ordering procedure	Valves, subplates, bolt kits and Vickers amplifiers should be ordered by full model code designation. Order ISO (DIN) electrical connectors by part number.

## Performance Data

Typical with oil at 36 cSt (168 SUS) and at 50°C (122°F)

### Pressure Override when Relieving

Model	Curve number								
	1	2	3	4	5	6	7	8	9
K(A)CG-**-40	•								
K(A)CG-**-100	•	•							
K(A)CG-**-160	•	•	•						
K(A)CG-**-250				•	•	•	•	•	•
K(A)CG-**-350				•	•	•	•	•	•



### Pressure Override Off-Load

Graphs show the minimum pressures obtainable:

- With 0 mA current to the solenoid coil
- When the valve is vented (see following explanation).

#### Venting

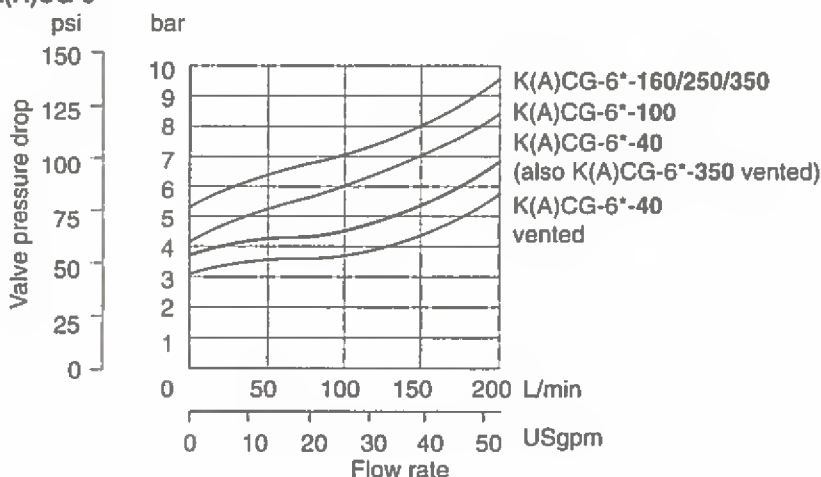
When the vent port X (or alternative vent port in the valve body) is connected to the reservoir via a suitable 2-way pilot valve, the mainstage of the relief valve opens to allow full flow from P to T at low pressure drop. The minimum pressure drop is obtained when the pilot valve is also de-energized. The total pressure drop through the venting 2-way valve and pipework is additive to the pressure at P.

While the valve is vented the system pressure cannot be controlled via the proportional solenoid.

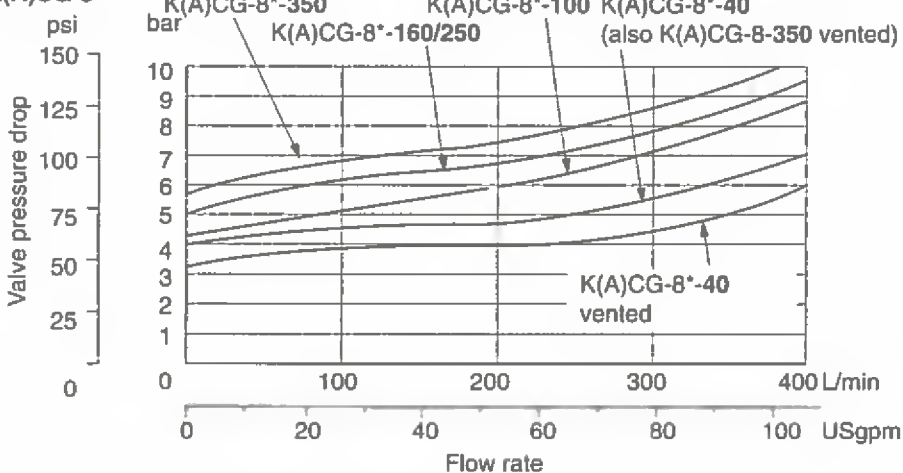
This control feature is frequently used during off-load periods in machine cycle times. If lower off-load system pressures are required then additional full flow unloading valves are recommended, e.g. Vickers CV series cartridge valves.

*Note: All valves are with pilot valve de-energized.*

#### K(A)CG-6

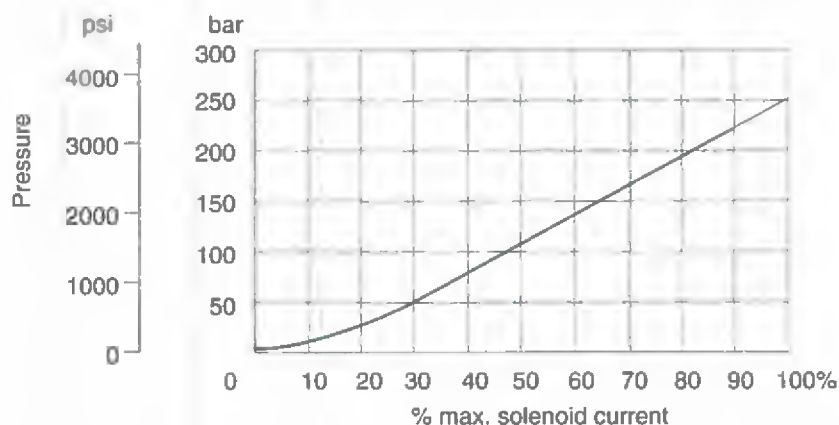


#### K(A)CG-8



Valid for models driven from Vickers amplifier with appropriate settings of gain and offset

## Pressure Gain



## Step Response

KACG models with factory settings of gain and offset.

KCG models driven from Vickers amplifier with appropriate settings of gain and offset.

Test method

1. Trapped volume between pump and test valve, as in table.
2. Flow rate set at pump, as in table.
3. Response = time from step input signal until pressure reaches 90% of step change, as measured by transducer.

Valve size	Test conditions: Trapped volume	Flow rate	Step size: Pressure demand	Response time (ms)
6	2.0 liters (0.53 USg)	100 L/min (26 USgpm)	0 to 100%	100
			100% to 0	70
			25 to 100%	40
			100 to 25%	50
8	4.0 liters (1.06 USg)	200 L/min (52 USgpm)	0 to 100%	110
			100% to 0	70
			25 to 100%	50
			100 to 25%	65

# KACG-6/8 Electrical Block Diagram

## Wiring

Connections must be made via the 7-pin plug mounted on the amplifier.

Recommended cable sizes are:

Power cables:

For 24V supply

0,75 mm<sup>2</sup> (18 AWG) up to 20m (65 ft)

1,00 mm<sup>2</sup> (17 AWG) up to 40m (130 ft)

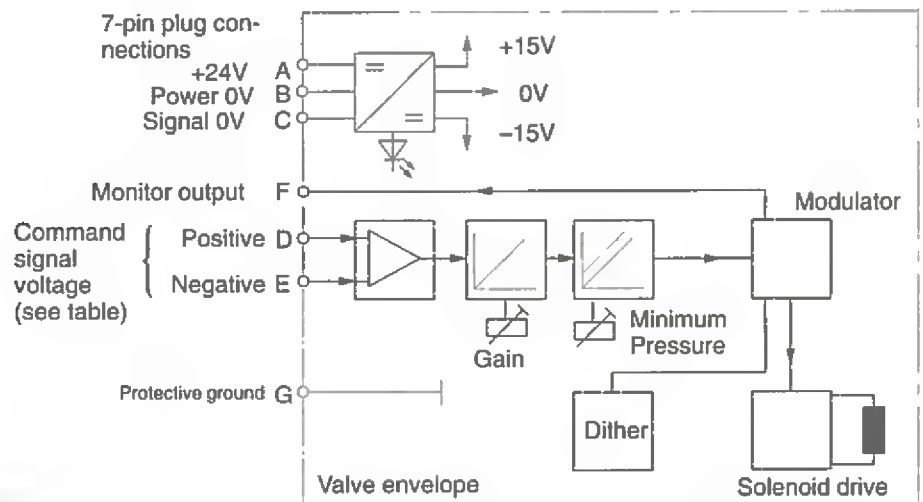
Signal cables:

0,50 mm<sup>2</sup> (20 AWG)

Screen:

A suitable cable would have 7 cores, a separate screen for the signal wires and an overall screen.

See wiring connection diagram on next page.



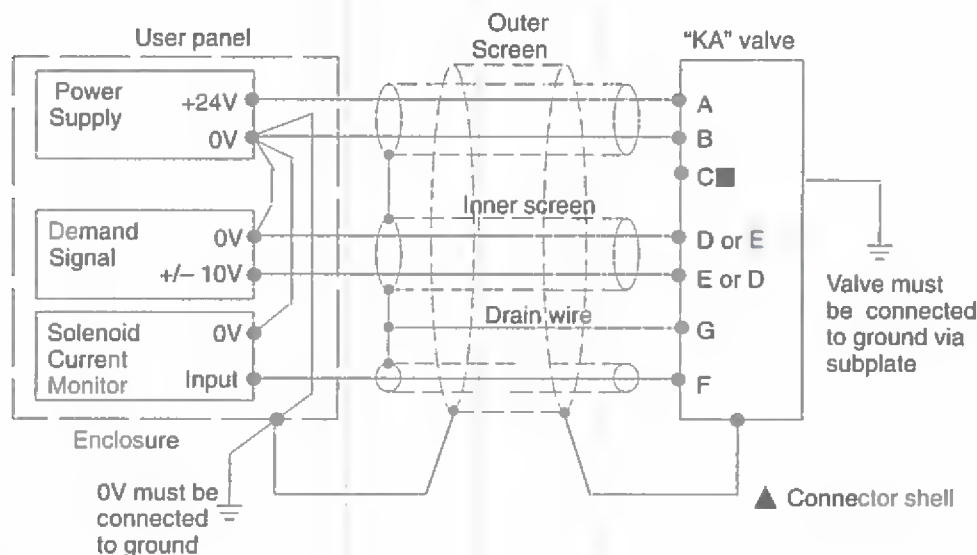
### Warning

*All power must be switched off before connecting or disconnecting any plugs.*



# KACG-6/8 Typical Connection Arrangements

## Wiring Connections for Valves with Integral Amplifier



■ Solenoid current monitor voltage (pin F) will be referenced to the KA valve local ground. A "local ground" (pin C) is provided for optional use by differential input customer supplied electronics.

▲ Note: In applications where the valve must conform to European RFI/EMC regulations, the outer screen (shield) must be connected to the outer shell of the 7-pin connector and the valve body must be fastened to the earth ground. Proper earth grounding practices must be observed in this case, as any differences in command source and valve ground potentials will result in a screen (shield) ground loop.



### Warning

Do not ground pin C. If the local ground (pin C) is not used for differential monitor electronics, do not use. Read monitor pin F with respect to ground.



### Warning

#### Electromagnetic Compatibility (EMC)

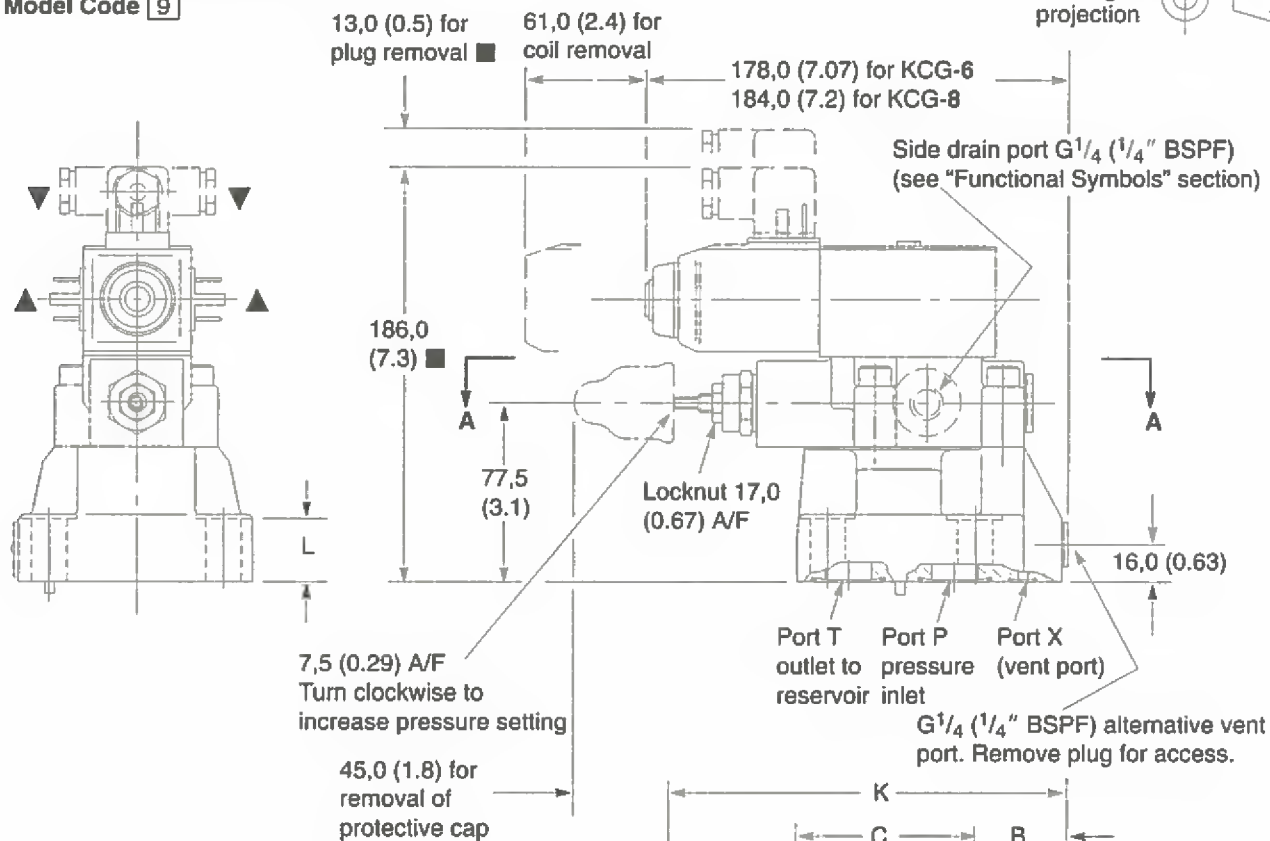
It is necessary to ensure that the valve is wired-up as above. For effective protection, the user electrical cabinet, the valve subplate or manifold, and the cable screens should be connected to efficient ground points. The metal 7-point connector, part no. 934939, should be used for the integral amplifier.

In all cases, both valve and cable should be kept as far as possible from any sources of electromagnetic radiation such as cables carrying heavy current, relays and certain kinds of portable radio transmitters, etc. Difficult environments could mean that extra screening may be necessary to avoid the interference.

It is important to connect the 0V lines as shown above. The multi-core cable should have at least two screens to separate the demand signal and monitor output from the power lines.

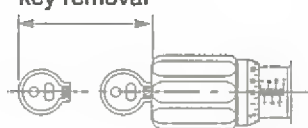
# Installation Dimensions in mm (inches)

## KCG-\* Models with "U" Type Coil Connection: "U" at Model Code **9**



## Micrometer Adjustment Options: "K" or "M" in Model Code **5**

Type K only:  
43,0 (1.7) for  
key removal

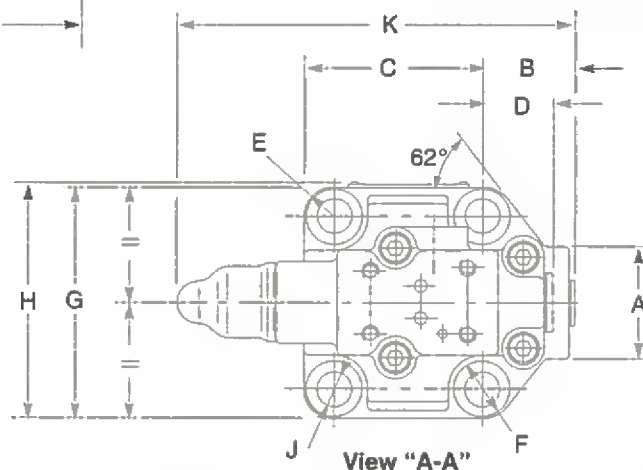


Mainstage overall dimension  
with adjuster knob fully out:  
196,0 (7.7) for KCG-6 models  
203,0 (8.0) for KCG-8 models

## "K" Feature:

To adjust pressure setting, insert key and turn clockwise. Turn micrometer knob clockwise to increase pressure setting; counter-clockwise to decrease setting. When the key is removed the knob can spin freely without affecting the pressure setting.

- ▲ Alternative plug positions by loosening knurled nut counter-clockwise, turning coil and re-tightening nut.
- Dimensions may vary according to source of plug.
- ▼ The cable entry on this plug can be repositioned at 90° intervals by reassembly of the contact holder relative to the plug housing. The cable entry is Pg 11 for cables Ø6-10 mm (0.24-0.4 dia).



Model	A	B	C	D	E rad	ØF (dia)
KCG-6	58,0 (2.3)	35,0 (1.4)	68,0 (2.7)	35,0 (1.4)	12,0 (0.5)	20,0 (0.78)
KCG-8	42,0 (1.7)	39,0 (1.54)	83,0 (3.3)	30,0 (1.2)	16,0 (0.63)	26,0 (1.02)

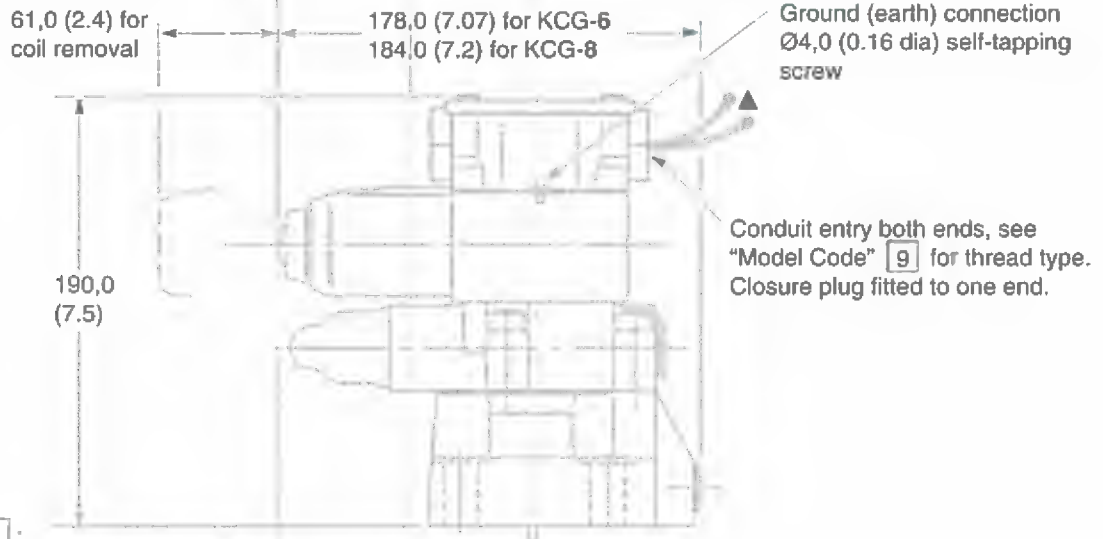
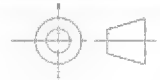
  

Model	G	H	ØJ (dia)	K	L
KCG-6	79,0 (3.1)	82,0 (3.23)	13,5 (0.53)	176,0 (7.0)	20,0 (0.78)
KCG-8	103,0 (4.1)	106,0 (4.2)	17,0 (0.7)	183,0 (7.2)	25,0 (1.0)

**KCG-\* Models with "F" Type Coil Connection:  
"F(T)W" or "F(T)J" at Model Code [9]**

For dimensions not shown see page B.209.

3rd angle  
projection



▲ Ref. Model Code [9]:

Codes "FJ" and "FW": 2 lead wires approx. 150.0 (6.0) long.  
M3 terminals provided for customer connection.  
Codes "FTJ" and "FTW": Lead wires connected into terminal  
strip suitable for M3 terminals on customer connection.

**KCG-\*—EN46 Models for Use with Vickers  
UNIPLUG, Single Cable Connector:  
"P" at Model Code [9]; "H" at Model Code [11]**

For use with Vickers single-cable UNIPLUG connectors:

**For "Soft Switch" Control:**

Use UNIPLUG model type EHH-AMP-724-C\*-1"

**For Proportional Control:**

Use UNIPLUG model type EHH-AMP-724-D\*-1"

UNIPLUG connectors should be ordered separately;  
see catalog 2367.

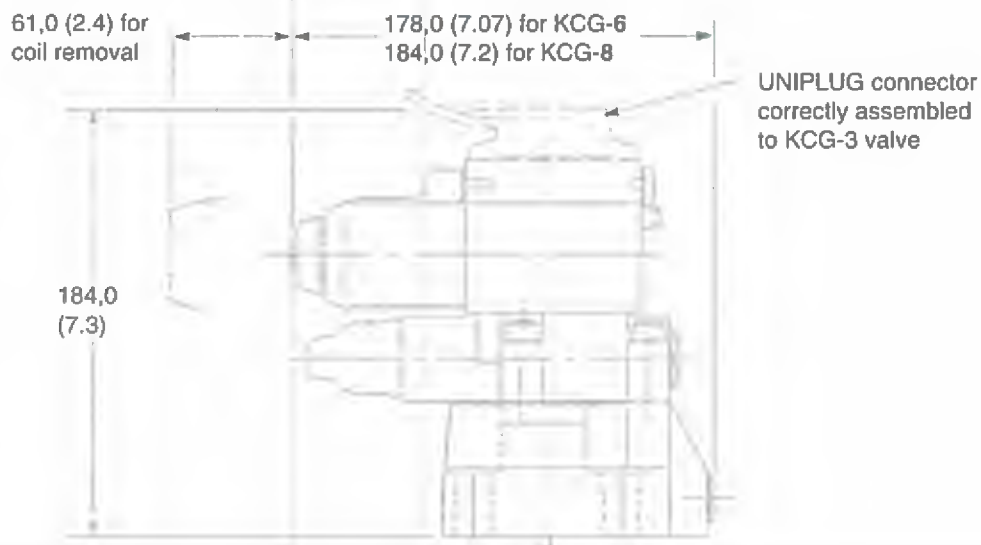
To fit UNIPLUG connector to KCG-3 pilot valve:

Unscrew coil retention nut and remove coil.

Slide UNIPLUG connector onto dummy pins (at non-solenoid  
end) then replace coil, ensuring pins are fully engaged.

Replace and tighten coil retention nut.

For dimensions not shown see page B.209.



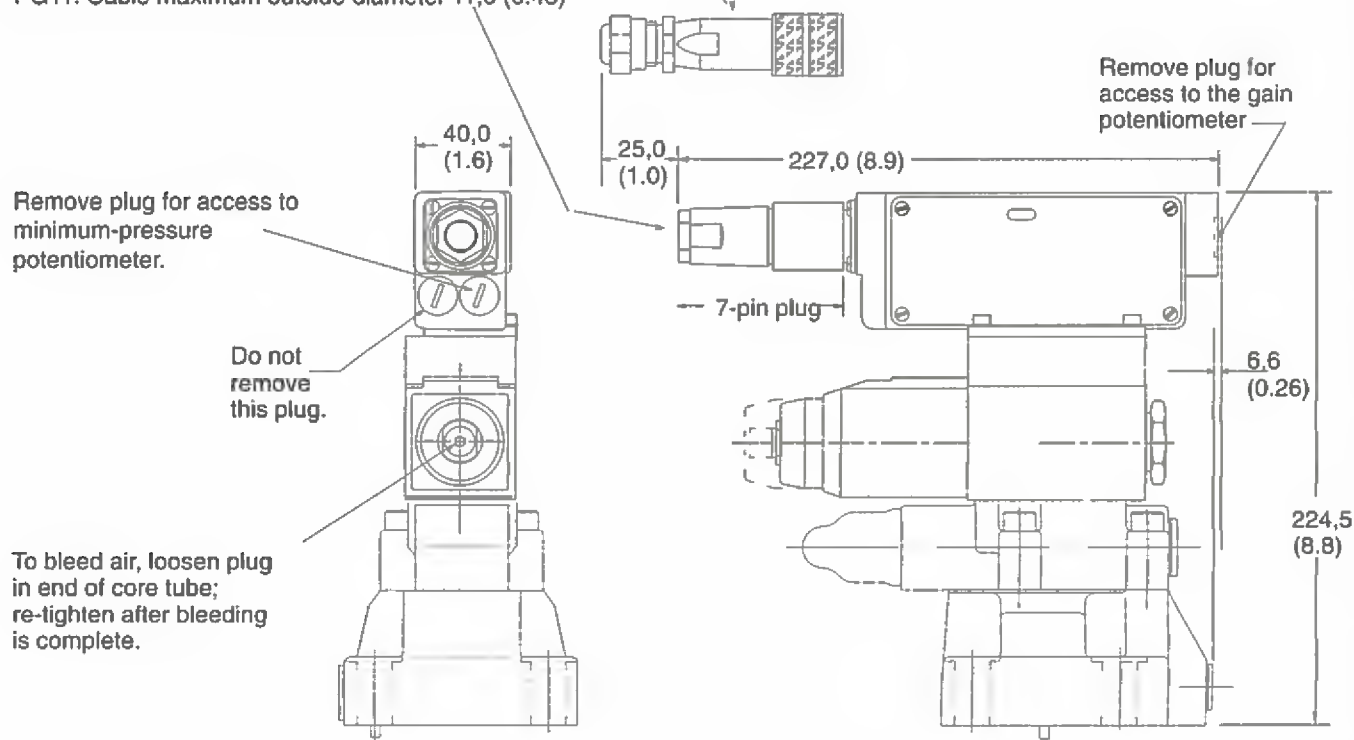
## KACG-\* Models (With integrated amplifier)

### Metal plug 934939

Cable outside diameter 8,0 to 10,5 (0.31 to 0.41)  
Must be used for full EMC protection. See also warning note below

### Plastic plug 694534

PG11. Cable maximum outside diameter 11,0 (0.43)



### Warning

To conform to the EC Electromagnetic Compatibility directive (EMC) this KACG valve must be fitted with a metal 7-pin plug. The screen of the cable must be securely connected to the shell of the metal connector. A suitable IP67 rated connector is available from Vickers, part no. 934939. Alternatively a non IP67 rated connector is available from ITT-Cannon, part no. CA 02 COM-E 14S A7 P.

Additionally the cable must be fitted with a ferrite EMC suppression core not more than 4cm from the connector referred to above. Suitable types include Farnell 535-898 or Farnell 535-904 which snap fit over the cable.

The plastic plug, part number 694534, is only suitable for use in a sealed electromagnetic environment or outside of the European Community.

# Mounting Surfaces, ISO 6264

AR-06-2-A

AS-08-2-A

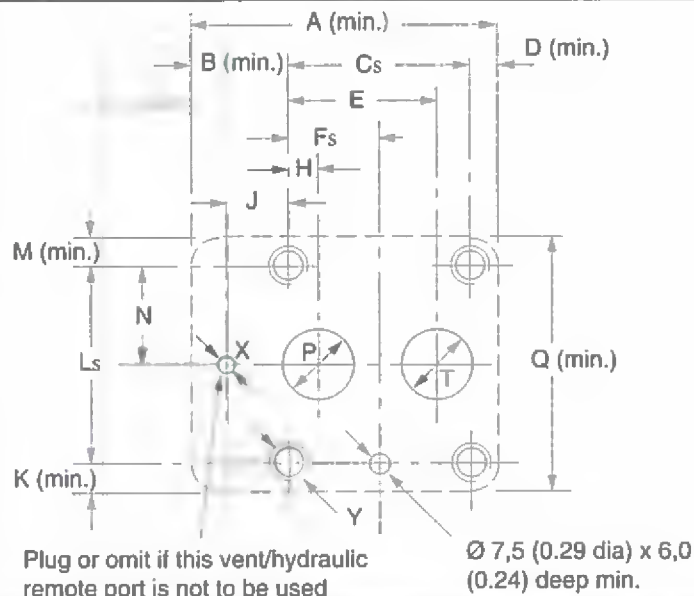
When a subplate is not used, a raised pad must be provided for mounting. The pad must be flat within 0,001 mm/100 mm (0.0001"/10") and smooth within 0,8 µm (32 µin). Dimensional tolerances are ±0,2 mm (± 0.008") except where indicated.

Port functions:

P = Pressure inlet

T = Outlet to reservoir

X = Vent, or remote control port



Size	A	B	C	D	E	F	H	J	K	L
AR-06	80 (3.2)	13,1 (0.5)	53,8 (2.12)	13,1 (0.5)	47,5 (1.87)	22,1 (0.87)	22,1 (0.87)	0	13,1 (0.5)	53,8 (2.12)
AS-08	118 (4.7)	35,0 (1.4)	66,7 (2.63)	16,3 (0.7)	55,6 (2.19)	33,4 (1.35)	11,1 (0.44)	23,8 (0.94)	16,0 (0.63)	70,0 (2.76)

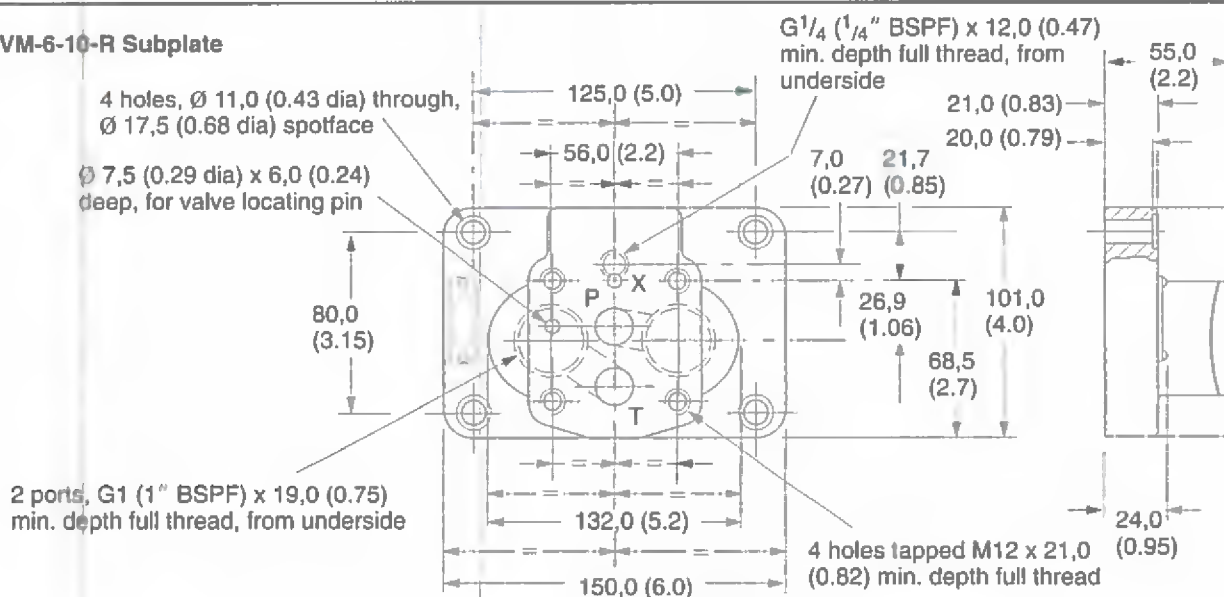
Size	M	N	ØP (dia)	Q	ØT (dia)	ØX (dia)	Y thread x min. full thread depth
AR-06	13,1 (0.5)	26,9 (1.06)	14,7 (0.58)	80 (3.2)	14,7 (0.58)	4,8 (0.19)	M12 x 21 (7/16" UNF x 0.83)▼
AS-08	16,0 (0.63)	35,0 (1.38)	23,4 (0.92)	102 (4.0)	23,4 (0.92)	6,3 (0.25)	M16 x 30 (5/8" UNF x 1.2)▼

▲ Tolerance on bolt and pin locations ± 0,1 mm (± 0.004").

◆ These ISO standard dimensions can be used, but improved flow paths to and from valve are obtained by using 48,0 (1.89) instead of 47,5 (1.87), and 22,6 (0.89) instead of 22,1 (0.87).

▼ ISO standard does not give UNC bolt sizes. These are recommended equivalents to metric sizes specified in the standard.

## CGVM-6-10-R Subplate



## Further Information

### Hydraulic Fluids

Materials and seals used in these valves are compatible with:

Anti-wear petroleum oils ..... L-HM

For use with non-alkyl based phosphate esters, L-HFD, use F3 version in model code.

The extreme operating range is 500 to 13 cSt (270 to 70 SUS) but the recommended running range is 54 to 13 cSt (245 to 70 SUS). For further technical information about fluids see Technical Information leaflet B-920 or I-286-S.

### Contamination Control Requirements

Recommendations on contamination control methods and the selection of products to control fluid condition are included in Vickers publication 9132 or 561, "Vickers Guide to Systemic Contamination Control". The book also includes information on the Vickers concept of "ProActive Maintenance". The following recommendations are based on ISO cleanliness levels at 2 µm, 5 µm and 15 µm.

For products in this catalog the recommended levels are:

Up to 210 bar (3000 psi) ..... 18/16/13

Above 210 bar (3000 psi) ..... 17/15/12

### Installation and Start-up Guidelines

The proportional valves in this catalog can be mounted in any attitude but it may be necessary, in certain demanding applications, to ensure that the solenoids are kept full of hydraulic fluid.

If this proves to be the case any accumulated air can be bled from the solenoid bleed screw. This task is easier if the valve has been mounted base downwards. Good installation practice dictates that the tank port, and any drain port, are piped so as to keep the valve full of fluid once the system start-up has been completed.

### Temperatures

For petroleum oil:

Min. .... -20°C (-4°F)

Max.\* ..... +70°C (158°F)

\* To obtain optimum service life from both fluid and hydraulic system, 65°C (150°F) normally is the maximum temperature.

For other fluids where limits are outside those of petroleum oil, consult fluid manufacturer or Vickers representative. Whatever the actual temperature range, ensure that viscosities stay within those specified under "Hydraulic Fluids".

Ambient for:

Valves at full performance specification: -20 to +60°C (-4 to +140°F).

Valves, as above, will operate at temperatures of 0 to -20°C (32 to -4°F) but with a reduced dynamic response.

Storage:

-25 to +85°C (-13 to +185°F)

Eurocard electronics:

0 to 50°C (32 to 122°F)

### Seal Kits

Pilot valves:

K(A)CG-3 (KA + DIN) ..... 02-138201

KCG-3 ('F' & 'P' versions) .. 02-145869

Mainstage valves:

K(A)CG-6 ..... 614824

K(A)CG-8 ..... 614931



## Proportional Pressure Reducing Valves

### K(A)X(C)G-6/8, 1\* Series

#### Basic Characteristics

Max. inlet pressure . 350 bar (5000 psi)  
 Max. reduced pressure . . . . . 330 bar (4750 psi)  
 Max. flow rate . . 300 L/min (80 USgpm)  
 Mounting face to ISO 5781 (B port high pressure inlet):  
 For K(A)X(C)G-6 . . . . . AG-06-2-A  
 For K(A)X(C)G-8 . . . . . AH-08-2-A

#### General Description

These two-stage pressure reducing valves (based on Vickers type X(C)G2V valves, featured in catalog 2321) incorporate an electro-hydraulic proportional pressure pilot stage (Vickers type KCG-3 valve, described in catalog 2162) by which the reduced pressure setting is adjustable in response to an electrical input. Each model (in two sizes, with optional free reverse flow check valve) responds to variations of current input to its solenoid, for which separate Vickers drive amplifiers, with PWM output stage and output current control, are available.

#### Design Features

A maximum outlet pressure to suit the application requirements is preset by the manual adjustment. Below this maximum setting, the outlet pressure is controlled by the solenoid operated proportional pilot valve, according to the current applied to the solenoid.

The "normally open" condition of the mainstage allows full flow from inlet to outlet port until the required reduced pressure is reached, whereupon the mainstage closes, or reduces the flow sufficient only to maintain the required outlet pressure.

High valve response ensures that the reduced outlet pressure is unaffected by inlet pressure peaks. Excess build-up of outlet pressure (during long holding periods, or flow back from an actuator reacting to an overload) is prevented by the small check valve in the mainstage spool, allowing fluid to bleed-off across the pilot stage.

#### KAX(C)G-6/8

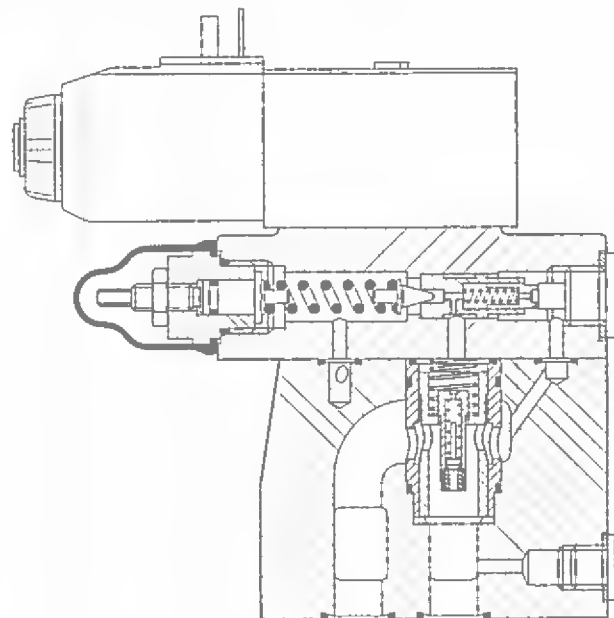
The addition of an integral amplifier allows the pressure to be controlled from a 0 to +10V, or 0 to -10V command signal range. The amplifier is mounted in a robust metal housing and electrical


connections are via an industry standard 7-pin plug. Factory-set adjustments ensure high reproducibility valve-to-valve.

#### Features and Benefits

- Remote electrical proportional control of reduced pressure from a choice of five pressure ranges per valve size.
- Excellent repeatability and stable performance results from cartridge design of mainstage parts.
- Low installed cost and space requirement from high power/size ratios (more than double that of many conventional designs).

KX(C)G-6 Valve with Type "U" Coil Connection



This product has been designed and tested to meet specific standards outlined in the European Electromagnetic Compatibility Directive (EMC) 89/336/EEC, amended by 91/263/EEC, 92/31/EEC and 93/68/EEC, article 5. For instructions on installation requirements to achieve effective protection levels, see this leaflet, the Installation Wiring Practices for Vickers Electronic Products leaflet 2468 and leaflet 02-123931A which is packed with every KA valve. Wiring practices relevant to this Directive are indicated by  Electromagnetic Compatibility (EMC).

## Functional Symbols

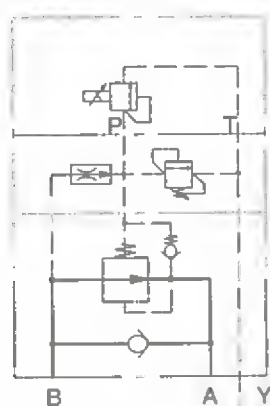
### Manual and Electrical Pilots

Drained to Port Y:

Model Code **7** = Blank

Symbol for KXCG models.

For KXG models omit check and internal connection A-B.



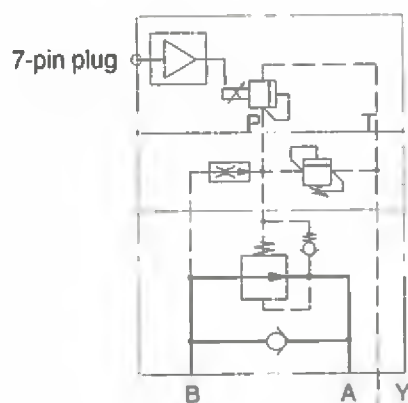
### Manual and Electrical Pilots

Drained to Port Y:

Model Code **7** = Blank

Symbol for KAXCG, models with integral amplifier.

For KAXG models omit check and internal connection A-B.

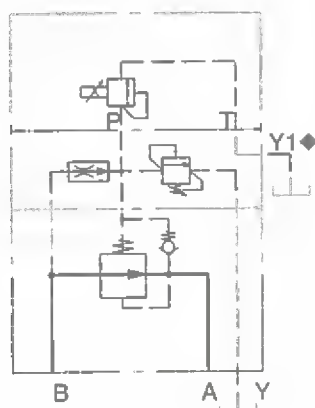


Manual Pilot Drained to Port Y;  
Electrical Pilot Drained to Port Y1◆:

Model Code **7** = 3

Symbol for KXG models.

For KXCG models add check valve symbol and internal connection A-B.

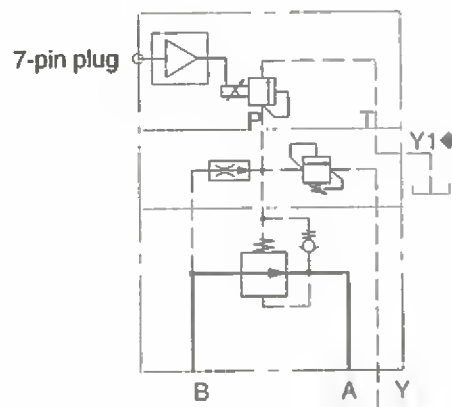


Manual Pilot Drained to Port Y;  
Electrical Pilot Drained to Port Y1◆:

Model Code **7** = 3

Symbol for KAXG, models with integral amplifier.

For KAXCG models add check valve symbol and internal connection A-B.



## Model Code

Features in brackets ( ) may be omitted. All other features must be specified.

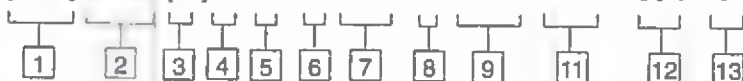
Models requiring separate amplifiers

**(F3-)KX(C)G- \* - \* \*\*\* -\*-Z-M- \*\*\* - \*\*\* -1\*(-EN46)**



Models with integral amplifier

**(F3-)KAX(C)G- \* - \* \*\*\* -\*-Z-M-PD7- H1 -1\***



### 1 Fluid compatibility

Blank = Antiwear hydraulic oil  
(class L-HM)

F3 = As above or phosphate ester  
(class L-HFD)

### 2 Valve type

KX = Proportional pressure relief

KAX = Proportional pressure relief  
with integral amplifier

### 3 Reverse flow check

C = Reverse flow check

Omit if not required

### 4 Mounting type

G = Subplate mounted

### 5 Mounting surface, ISO 6264

With port B high pressure inlet and  
port A reduced pressure outlet

6 = AR-06-2/A

8 = AS-08-2/A

### 6 Type of manual adjustment

K = Micrometer with keylock

M = Micrometer without keylock

W = Screw/locknut

### 7 Reduced pressure adjustment control range ( see footnote)

(All coils except type HJ, see  
position 12 footnote ■ )

40 = 10 - 40 bar (145 - 580 psi)

100 = 12 - 100 bar (175 - 1450 psi)

160 = 14 - 160 bar (200 - 2300 psi)

250 = 15 - 250 bar (220 - 3600 psi)

330 = 15 - 330 bar (220 - 4750 psi)

### 8 Pilot drain options

See also "Functional Symbols"

### 9 Standard features

Z-M = For KX(C)G-6/8 and

KAX(C)G-6/8

### 10 Coil connection type (KCG only)

U = ISO 4400 (DIN43650)  
interface▼

FW = Flying-leads in wiring box  
tapped 1/2" NPT

FTW= As "FW" plus terminal strip

FJ = Flying-leads in wiring box  
tapped M20

FTJ = As "FJ" plus terminal strip

P = Plug-in coil (type "H" only)  
Use with "EN46"

▼ Female connector to be supplied  
by user.

### 11 Connections (KACG only)

PD7 = 7 pin connector with plastic  
plug.

See **Warning** note regarding EC  
compliance on page B.225.

### 12 Coil rating

Code = amps x ohms ◆

G1 = 3,5 x 1,65

GP1 = 3,0 x 2,0

H1 = 1,6 x 7,3▼

HA1 = 0,94 x 22

HJ1 = 1,0 x 14,25■

HL1 = 0,80 x 29●

◆ Resistance at 20° C (68° F).

▼ KACG valves must have H1 coils

1 For valves replacing CGEV models.

■ This lower power coil is limited to  
the following maximum controlled  
pressures. Valves supplied with type  
HJ coils will be stamped with the  
applicable maximum controlled  
pressure.

Model code position 7	Max. pressure with HJ coil
40	35 bar (500 psi)
100	85 bar (1100 psi)
160	140 bar (2000 psi)
250	210 bar (3000 psi)
330	315 bar (4500 psi)

### 13 Design number, 1\* series

Subject to change. Installation  
dimensions unaltered for design  
numbers 10 to 19 inclusive.

### 14 Special features

EN46 used with P-type coil connection  
and Uniplug connector.  
Omit if not required.

*Note: Reduced pressure adjustment  
range 7 is based on an inlet pressure  
of 350 bar (5000 psi). With an inlet  
pressure of 100 bar (1450 psi) the lower  
limits are 2 to 3 bar (30 to 40 psi) lower.*

## Operating Data

Standard test conditions are with antiwear hydraulic oil at 36 cSt (168 SUS) and 50°C (122°F)

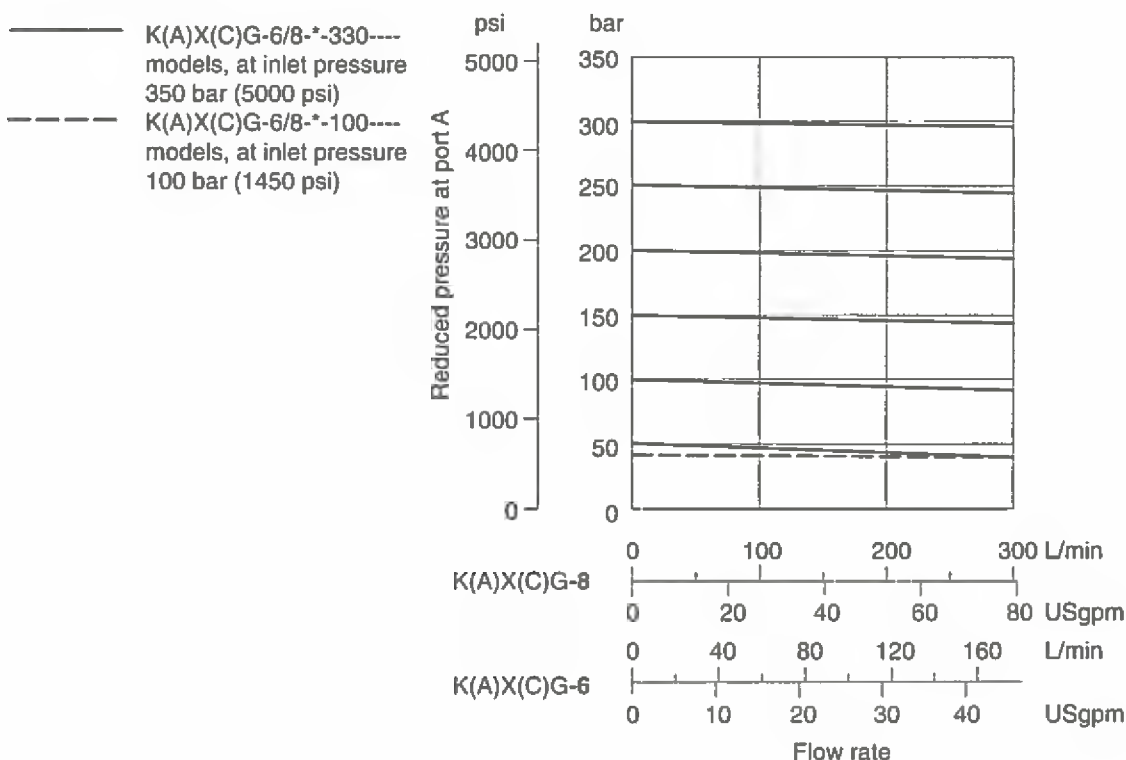
Maximum pressures: Port B (pressure inlet) Port A (reduced pressure outlet) Port Y▲ and side drain port Y1▲ ▲ Back pressure at these ports is additive to the reduced pressure setting of the valve.	350 bar (5000 psi) See <b>7</b> in "Model Code" 2 bar (30 psi)
Rated flow at $\Delta p = 12$ bar (175 psi) and 0 mA to coil: K(A)X(C)G-6 K(A)X(C)G-8	200 L/min (53 USgpm) 300 L/min (80 USgpm)
Pressure adjustment ranges	See <b>7</b> in "Model Code"
Minimum pressure differential ( $P_B - P_A$ ) for effective reduced pressure control, all models	20 bar (300 psi)
Pilot control drain flow, all models	1,5 L/min (0.4 USgpm) max.
Coil or amplifier rating KX(C)G KAX(C)G	See <b>12</b> in "Model Code" 24V x 40W max. (22 to 36V incl. 10% pk. to pk. max.ripple)
Command signal ranges, KAC(C)G models	0 to +10V DC, or 0 to - 10V DC
Dither, KAX(C)G models	Factory set, not user adjustable
Monitor point signal, KAX(C)G models	0,5V per amp. solenoid current
Power stage PWM, KAX(C)G models	2kHz nominal
7-pin plug connections, KAX(C)G models: A B C D E F G	Power supply +ve Power 0V Signal 0V +ve voltage command signal -ve voltage ccommand signal Monitor output Protective ground
Electro-magnetic compatibility (EMC) KAX(C)G models only: Emission (10v/m) Immunity (10v/m)	EN 50081-2 EN 50082-2
Pressure gain Factory setting - Maximum with 10V command signal. User adjustment - 30 to 120% of factory setting. Note that altering this setting will affect valve to valve interchangeability.	See graph
Pressure underride	See graph
Hysteresis, using Vickers drive amplifier KX(C)G KAX(C)G	<6% <7%
Linearity at conditions: 1. "Dead-head" (no flow from reduced pressure outlet port) 2. Between 10% and 100% rated pressure	<6% of rated pressure
Repeatability	< $\pm 1,3\%$ of rated pressure
Protection, Electrical (KA(C)G models)	Reverse-polarity protected

Mass (weight)	
KCG-6	4,9 kg (10.8 lb)
KACG-6	5,3 kg (11.7 lb)
KCG-8	5,8 kg (12.8 lb)
KACG-8	6,2 kg (13.7 lb)
Supporting products:	
Amplifiers for KCG valves with "H" type coils only:	
EHH-AMP-724-C/D-10 (Uniplug)	See catalog 2367
EHH-AMP-7*2 series (power plug)	See catalogs 2114, 2115 and 2282
EEA-PAM-513-A-14 (1 adjustable ramp)	See catalog 2137
EEA-PAM-513-A-3* (2 adjustable ramps)	See catalog 2464
Auxilliary electronic modules (Din-rail mounting) for KACG models:	
EHA CON 201 A 2* signal converter	See catalog 2410B
EHD DSG 201 A 1* command signal generator	See catalog 2470
EHA RMP 201 A 2* ramp generator	See catalog 2410B
EHA PID 201 A 2* PID controller	See catalog 2427
EHA PSU 201 A 1* power supply	See catalog 2410B
ISO 4400 (DIN 43650) electrical connector:	
Black, marked "B"	Part number 710775
Gray, marked "A"	Part number 710776
Subplates, size 03	See catalog 2425
Mounting bolts ■	See catalog 2314A
■ <i>Note: If not using Vickers recommended bolt kits, bolts must be to ISO 898 grade 12.9 or stronger.</i>	
Installation and start-up (commissioning):	
Installation and start-up (commissioning) guide	ML-B-9133B (Multi-lingual English, German, French and Italian), shipped with each product and also available separately on request.
Mounting attitude	No restriction, provided that the valve is kept full of fluid through port T.
Ordering procedure	Valves, subplates, bolt kits and Vickers amplifiers should be ordered by full model code designation. Order ISO (DIN) electrical connectors by part number.

## Performance Data

Typical with oil at 36 cSt (168 SUS) and at 50°C (122°F)

### Pressure Underride



### Pressure Drop

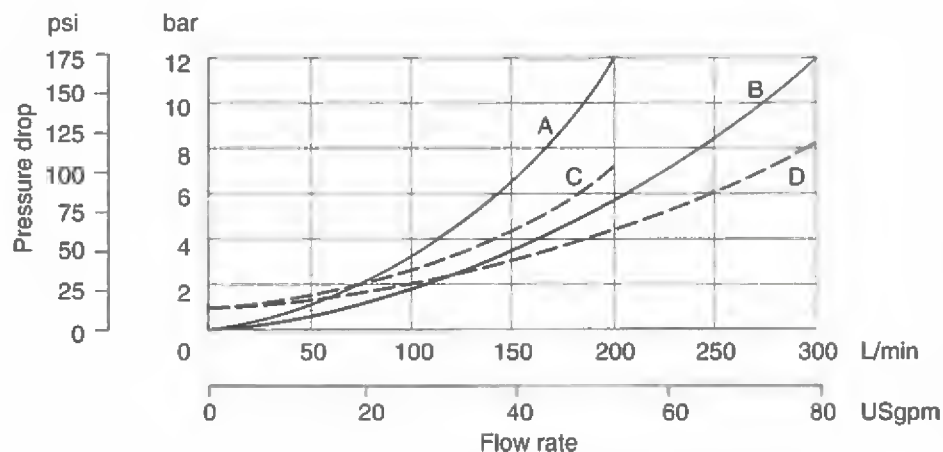
From port B to A at pressures below reduced pressure setting:

K(A)X(C)G-6 valves ..... Curve A  
 K(A)X(C)G-8 valves ..... Curve B

From port A to B through check valve (mainstage assumed closed).

Types K(A)XCG only:

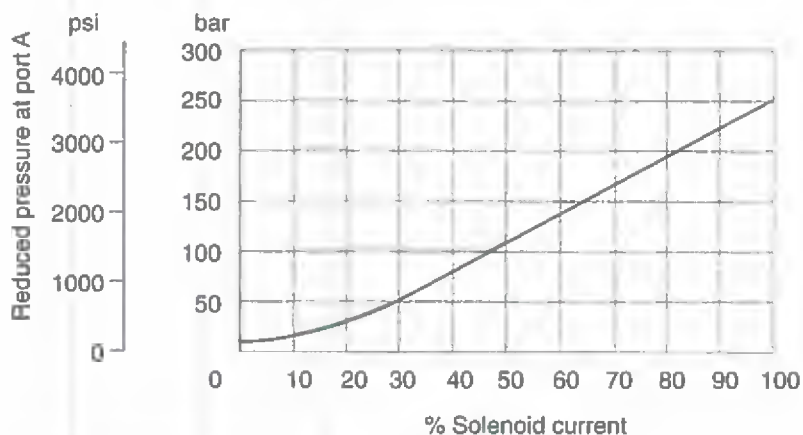
K(A)XCG-6 valves ..... Curve C  
 K(A)XCG-8 valves ..... Curve D





### Pressure Gain

Typical example K(A)X(C)G-6/8-250, at inlet pressure 350 bar (5000 psi). Valid for models driven from Vickers amplifier with appropriate settings of gain and offset.



### Step Response

Typical data for K(A)X(C)G-6/8-250 model with factory settings of gain and offset and KX(C)G-6/8-250 driven by Vickers Eurocard amplifier with appropriate settings of gain and offset, and with a ramp time of 80 ms ▲.

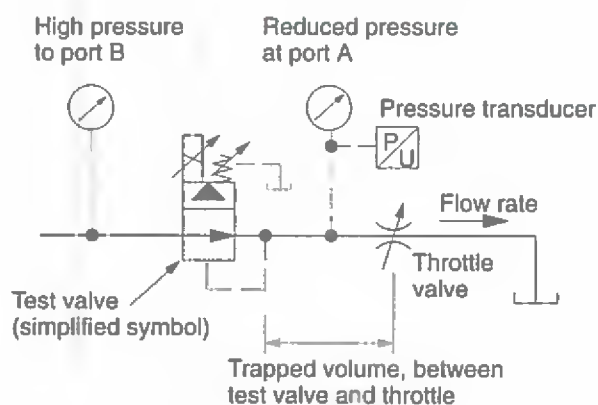
▲ Recommended minimum ramp rate to avoid excessive pressure overshoot: 80 ms/100% solenoid current.

Valve size	Test conditions: Trapped volume	Flow rate	Step size: Pressure demand	Response time (ms)
6	1,5 liters (0.4 USg)	75 L/min (20 USgpm)	0 to 100%	75
			100% to 0	60
			25 to 100%	60
			100 to 25%	50
8	3,0 liters (0.8 USg)	150 L/min (40 USgpm)	0 to 100%	70
			100% to 0	70
			25 to 100%	45
			100 to 25%	70

### Test method

1. Inlet pressure set 300 bar (4350 psi)
2. Trapped volume as in table
3. Steady state flow rate adjusted by downstream throttle valve with  $\Delta p = 250$  bar (3600 psi)
4. Response = time from step input signal until reduced output pressure reaches 90% of step change, as measured by transducer

Test Circuit



# KAX(C)G-6/8 Electrical Block Diagram

## Wiring

Connections must be made via the 7-pin plug mounted on the amplifier.

Recommended cable sizes are:

Power cables:

For 24V supply

0,75 mm<sup>2</sup> (18 AWG) up to 20m (65 ft)

1,00 mm<sup>2</sup> (17 AWG) up to 40m (130 ft)

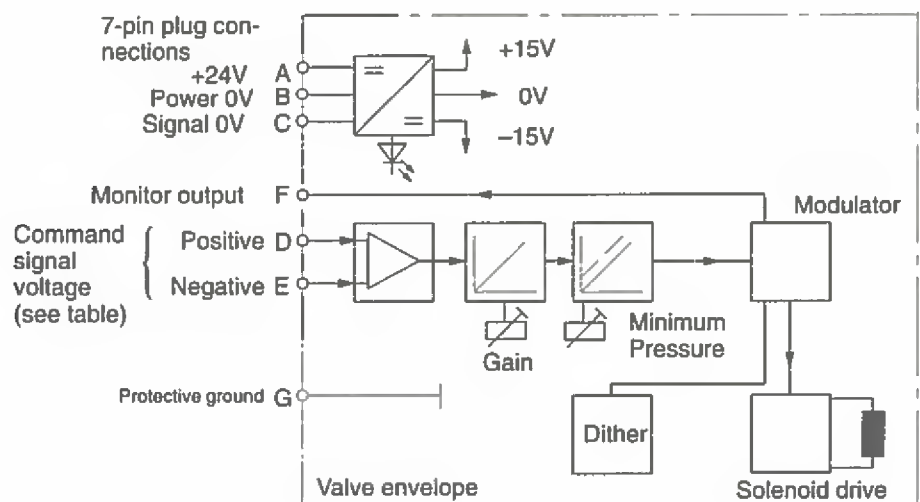
Signal cables:

0,50 mm<sup>2</sup> (20 AWG)

Screen:

A suitable cable would have 7 cores, a separate screen for the signal wires and an overall screen.

See wiring connection diagram on next page.

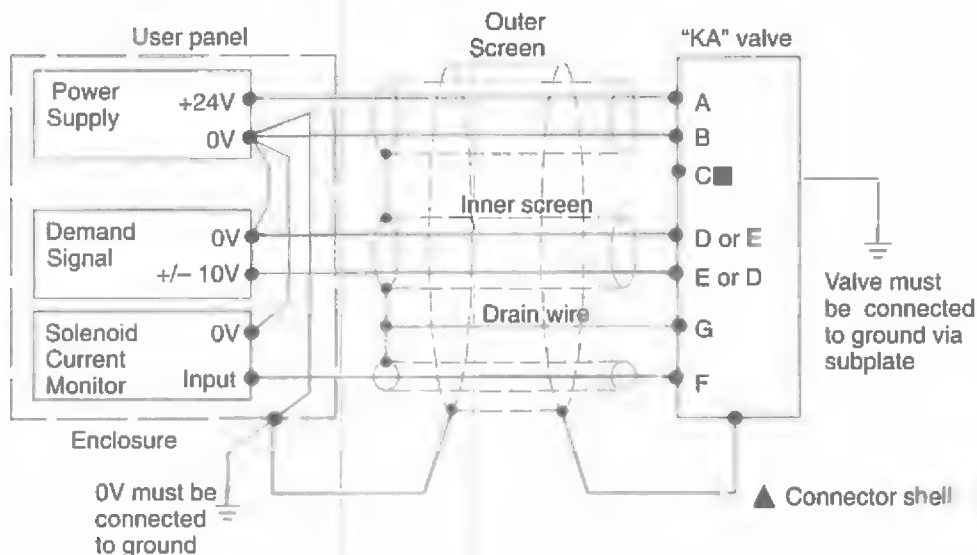


### Warning

All power must be switched off before connecting or disconnecting any plugs.

# KAX(C)G-6/8 Typical Connection Arrangements

## Wiring Connections for Valves with integral Amplifier



■ Solenoid current monitor voltage (pin F) will be referenced to the KA valve local ground. A "local ground" (pin C) is provided for optional use by differential input customer supplied electronics.

▲ Note: In applications where the valve must conform to European RFI/EMC regulations, the outer screen (shield) must be connected to the outer shell of the 7-pin connector and the valve body must be fastened to the earth ground. Proper earth grounding practices must be observed in this case, as any differences in command source and valve ground potentials will result in a screen (shield) ground loop.



### Warning

Do not ground pin C. If the local ground (pin C) is not used for differential monitor electronics, do not use. Read monitor pin F with respect to ground.



### Warning

Electromagnetic Compatibility (EMC)

It is necessary to ensure that the valve is wired-up as above. For effective protection, the user electrical cabinet, the valve subplate or manifold, and the cable screens should be connected to efficient ground points. The metal 7-point connector, part no. 934939, should be used for the integral amplifier.

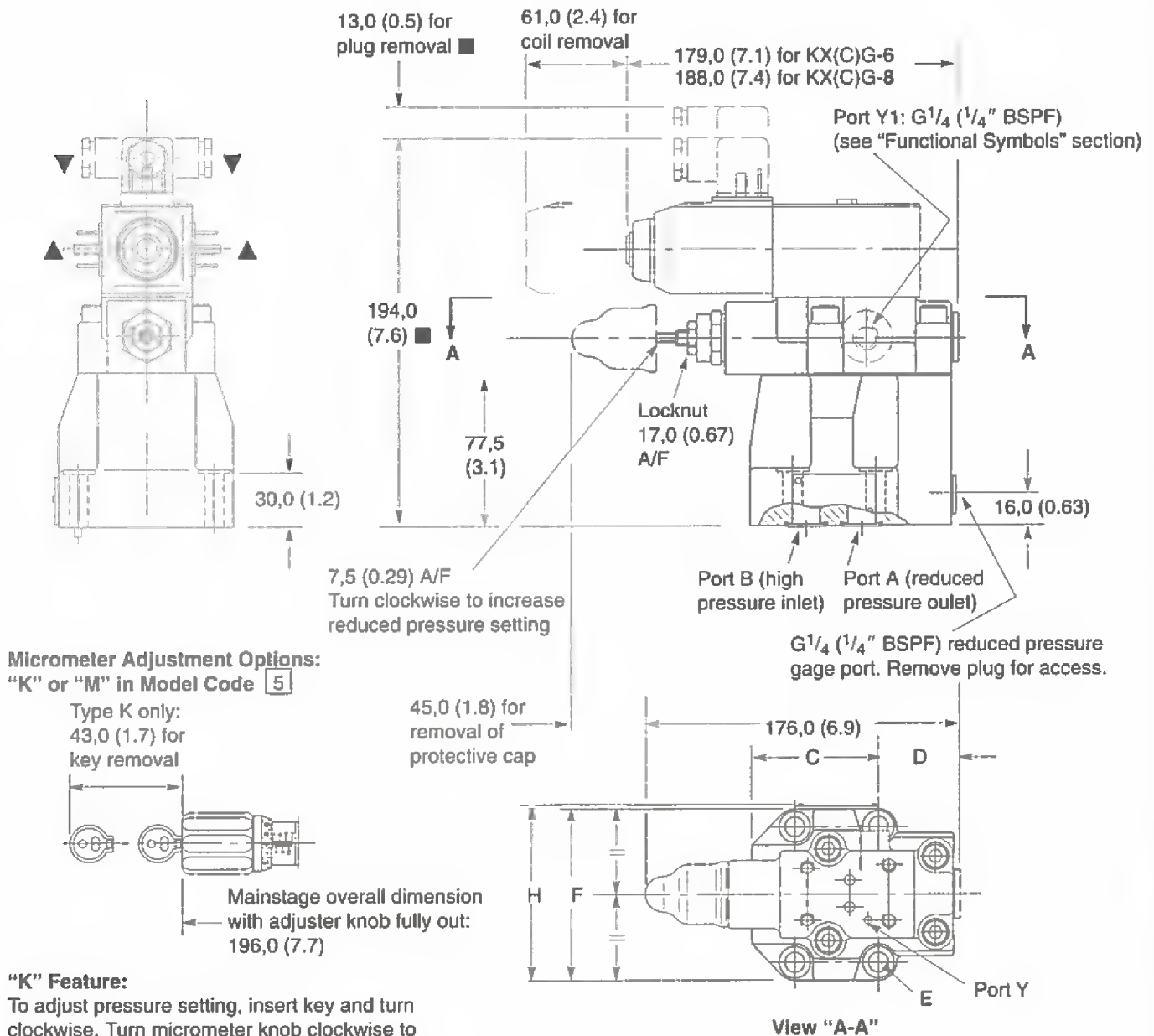
In all cases, both valve and cable should be kept as far as possible from any sources of electromagnetic radiation such as cables carrying heavy current, relays and certain kinds of portable radio transmitters, etc. Difficult environments could mean that extra screening may be necessary to avoid the interference.

It is important to connect the 0V lines as shown above. The multi-core cable should have at least two screens to separate the demand signal and monitor output from the power lines.

## Installation Dimensions in mm (inches)

KX(C)G-\* Models with Type "U" Coil Connection:  
"U" at Model Code **9**

3rd angle projection 



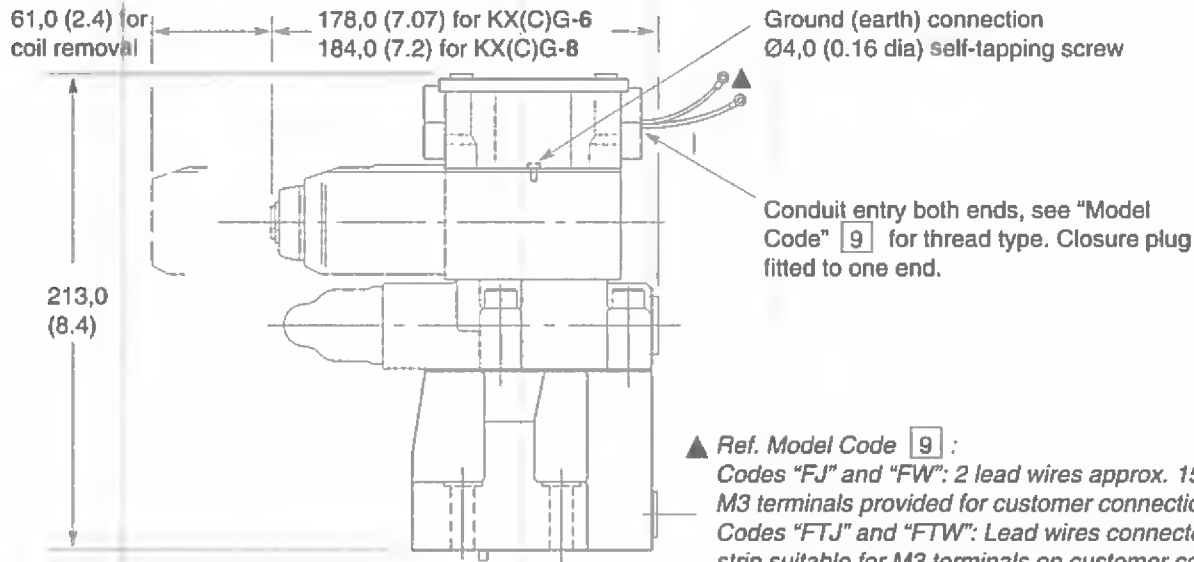
- ▲ Alternative plug positions by loosening knurled nut counter-clockwise, turning coil and re-tightening nut.
- Dimensions may vary according to source of plug.
- ▼ The cable entry on this plug can be repositioned at 90° intervals by reassembly of the contact holder relative to the plug housing. The cable entry is Pg 11 for cables Ø6-10 mm (0.24-0.4 dia).

Model	C	D	E rad.	F	H
KX(C)G-6	42,0 (1.7)	66,0 (2.6)	10,0 (0.4)	89,0 (3.5)	92,0 (3.65)
KX(C)G-8	40,0 (1.6)	77,0 (3.1)	11,0 (0.43)	104,0 (4.1)	107,0 (4.25)

**KX(C)G-\* Models with Type "F" Coil Connection:**  
**"F(T)W" or "F(T)J" at Model Code [7]**

For dimensions not shown see page B.223.

3rd angle  
 projection



**KX(C)G-\*—EN46 Models for Use with Vickers**  
**UNIPLUG, Single Cable Connector:**  
**"P" at Model Code [11] ; "H" at Model Code [11]**

For use with Vickers single-cable UNIPLUG connectors:

**For "Soft Switch" Control:**

Use UNIPLUG model type EHH-AMP-724-C\*-1\*

**For Proportional Control:**

Use UNIPLUG model type EHH-AMP-724-D\*-1\*

UNIPLUG connectors should be ordered separately;  
 see catalog 2367.

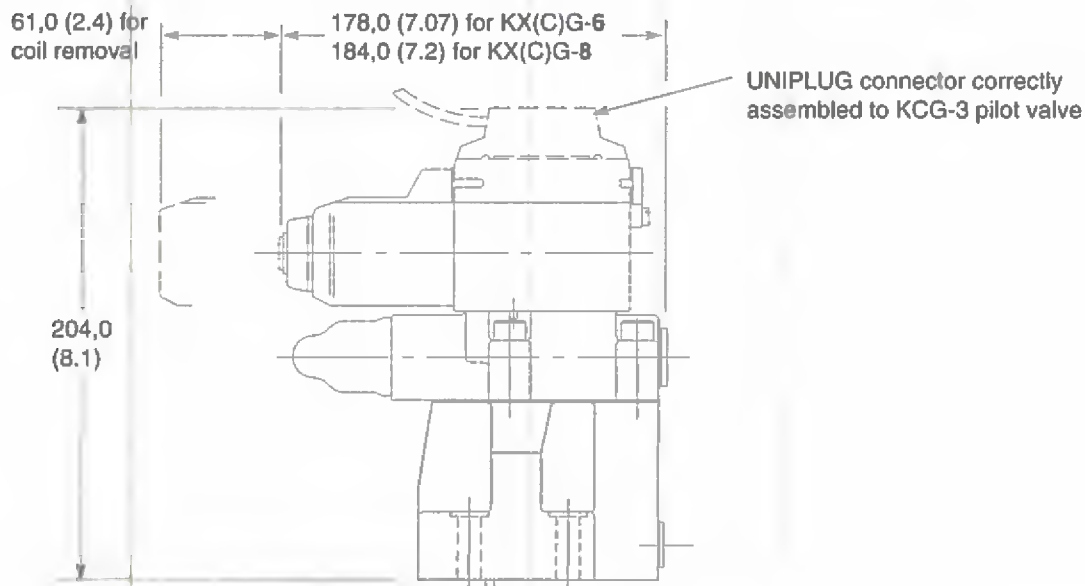
To fit UNIPLUG connector to KCG-3 pilot valve:

Unscrew coil retention nut and remove coil.

Slide UNIPLUG connector onto dummy pins (at non-solenoid end) then replace coil, ensuring pins are fully engaged.

Replace and tighten coil retention nut.

For dimensions not shown see page B.223.



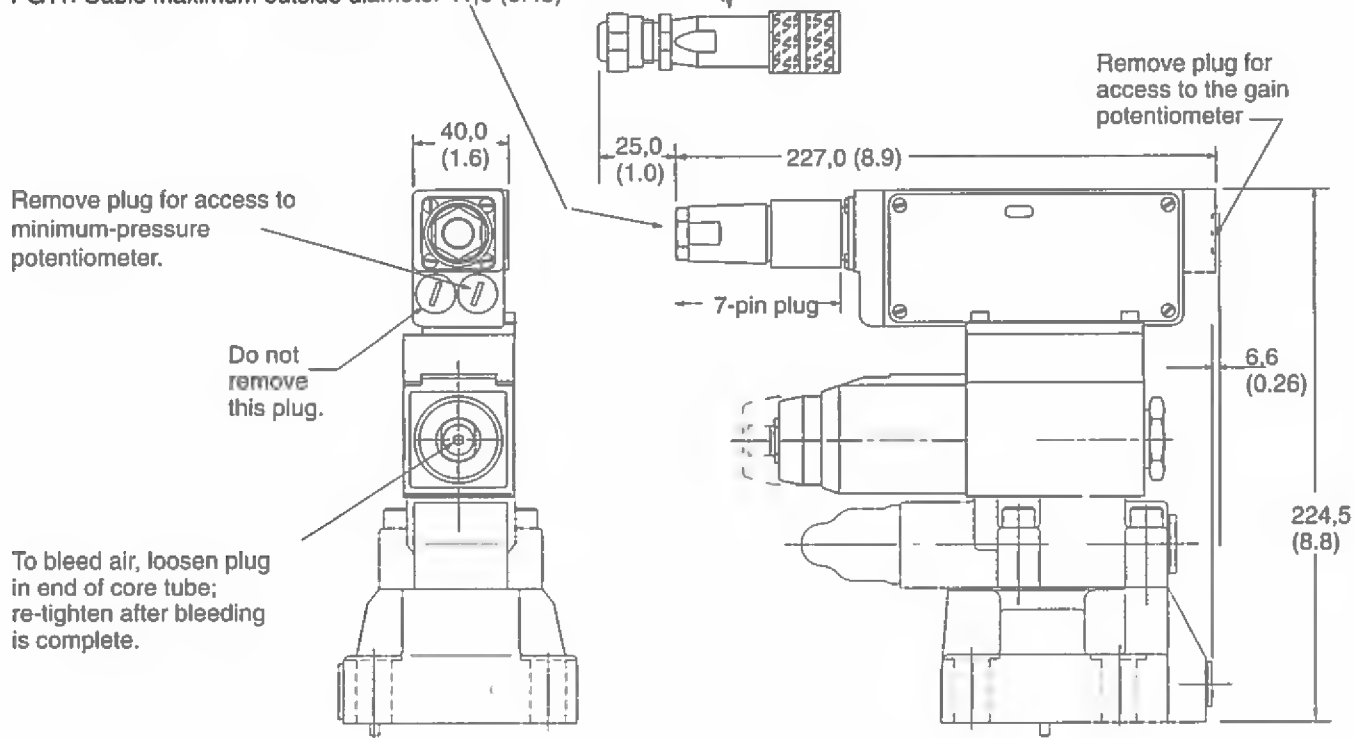
**KAX(C)G-\* Models (With integrated amplifier)**

**Metal plug 934939**

Cable outside diameter 8,0 to 10,5 (0.31 to 0.41)  
Must be used for full EMC protection. See also warning note below

**Plastic plug 694534**

PG11. Cable maximum outside diameter 11,0 (0.43)



**Warning**

To conform to the EC Electromagnetic Compatibility directive (EMC) this KACG valve must be fitted with a metal 7-pin plug. The screen of the cable must be securely connected to the shell of the metal connector. A suitable IP67 rated connector is available from Vickers, part no. 934939. Alternatively a non IP67 rated connector is available from ITT-Cannon, part no. CA 02 COM-E 14S A7 P.

Additionally the cable must be fitted with a ferrite EMC suppression core not more than 4cm from the connector referred to above. Suitable types include Farnell 535-898 or Farnell 535-904 which snap fit over the cable.

The plastic plug, part number 694534, is only suitable for use in a sealed electromagnetic environment or outside of the European Community.



# **Mounting Surfaces, ISO 5781 (B Port High Pressure Inlet)**

**AG-06-2-A**

**AH-08-2-A**

When a subplate is not used a raised machined pad must be provided for mounting. The pad must be flat within 0,001 mm/100 mm (0.0001"/10") and smooth within 0,8 µm (32 µin).

Dimensional tolerances are ± 0,2 mm (± 0.008") except where indicated.

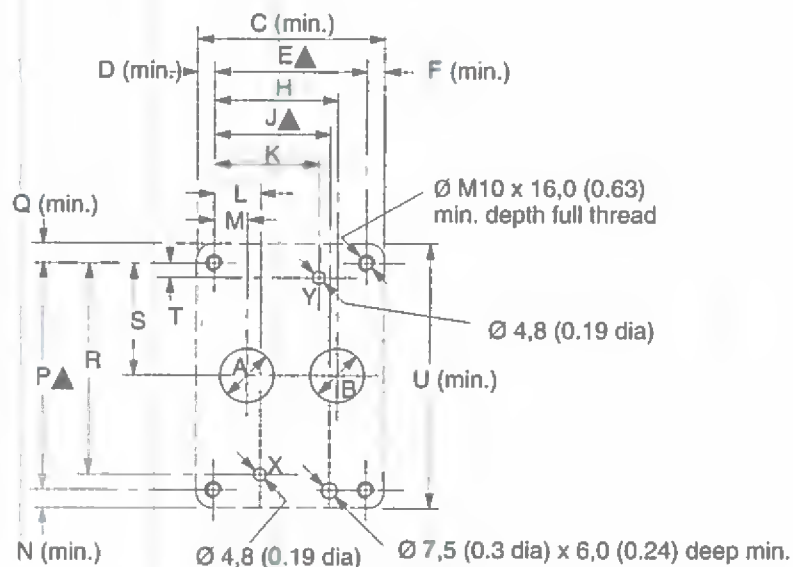
Port functions

**A =** Reduced pressure outlet (Also free reverse flow inlet for KXCG valves)

**B =** High pressure inlet (Also free reverse flow outlet for KXCG valves)

**X =** Not used for KX(C)G valves; can be omitted or plugged

**Y =** Drain port

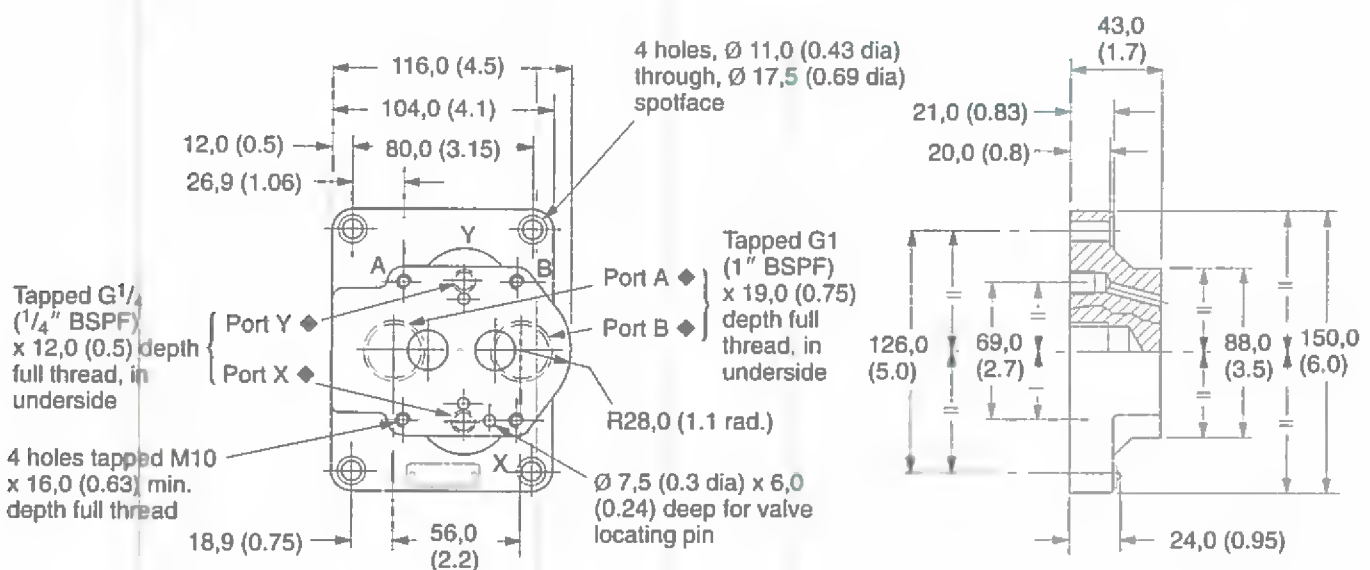


Size	A dia.	B dia.	C	D	E	F	H	J	K
06	14,7 (0.58)	14,7 (0.58)	61,0 (2.4)	9,0 (0.4)	42,9 (1.69)	9,0 (0.4)	35,7 (1.4)	31,8 (1.25)	21,4 (0.84)
08	23,4 (0.92)	23,4 (0.92)	78,0 (3.1)	8,8 (0.35)	60,3 (2.37)	8,8 (0.35)	49,2 (1.94)	44,5 (1.75)	39,7 (1.56)

Size	L	M	N	P	Q	R	S	T	U
06	21,4 (0.84)	7,1 (0.28)	10,0 (0.4)	66,7 (2.62)	10,0 (0.4)	58,7 (2.3)	33,3 (1.3)	7,9 (0.31)	87,0 (3.4)
08	20,6 (0.81)	11,1 (0.44)	10,8 (0.43)	79,4 (3.125)	10,8 (0.43)	73,0 (2.87)	39,7 (1.56)	6,4 (0.25)	101,0 (4.0)

▲ Tolerance on bolt and pin locations ± 0,1 mm (± 0.004").

## **XCGVM-6-10R Subplate**



◆ See "Mounting Surfaces" section above for port usage.

## Further Information

### Hydraulic Fluids

Materials and seals used in these valves are compatible with:

Anti-wear petroleum oils ..... L-HM

For use with Non-alkyl based phosphate esters (L-HFD), use F3 version in model code.

The extreme operating range is 500 to 13 cSt (270 to 70 SUS) but the recommended running range is 54 to 13 cSt (245 to 70 SUS). For further technical information about fluids see Technical Information leaflet B-920 or I-286-S.

### Contamination Control Requirements

Recommendations on contamination control methods and the selection of products to control fluid condition are included in Vickers publication 9132 or 561, "Vickers Guide to Systemic Contamination Control". The book also includes information on the Vickers concept of "ProActive Maintenance". The following recommendations are based on ISO cleanliness levels at 2 µm, 5 µm and 15 µm.

For products in this catalog the recommended levels are:

Up to 210 bar (3000 psi) ..... 18/16/13

Above 210 bar (3000 psi) ..... 17/15/12

### Installation and Start-up Guidelines

The proportional valves in this catalog can be mounted in any attitude but it may be necessary, in certain demanding applications, to ensure that the solenoids are kept full of hydraulic fluid.

If this proves to be the case any accumulated air can be bled from the solenoid bleed screw. This task is easier if the valve has been mounted base downwards. Good installation practice dictates that the tank port, and any drain port, are piped so as to keep the valve full of fluid once the system start-up has been completed.

### Temperatures

For petroleum oil:

Min. .... -20°C (-4°F)

Max.\* ..... +70°C (158°F)

\* To obtain optimum service life from both fluid and hydraulic system, 65°C (150°F) normally is the maximum temperature.

For other fluids where limits are outside those of petroleum oil, consult fluid manufacturer or Vickers representative. Whatever the actual temperature range, ensure that viscosities stay within those specified under "Hydraulic Fluids".

Ambient for:

Valves at full performance specification:

-20 to +60°C (-4 to +140°F).

Valves, as above, will operate at temperatures of 0 to -20°C (32 to -4°F) but with a reduced dynamic response.

Storage:

-25 to +85°C (-13 to +185°F)

Eurocard electronics:

0 to 50°C (32 to 122°F)

### Seal Kits

Pilot valves

K(A)CG-3 (KA + DIN) ..... 02-138201

KCG-3 ('F' & 'P' versions) .. 02-145869

Mainstage valves

K(A)X(C)G-6 ..... 614824

K(A)X(C)G-8 ..... 614826





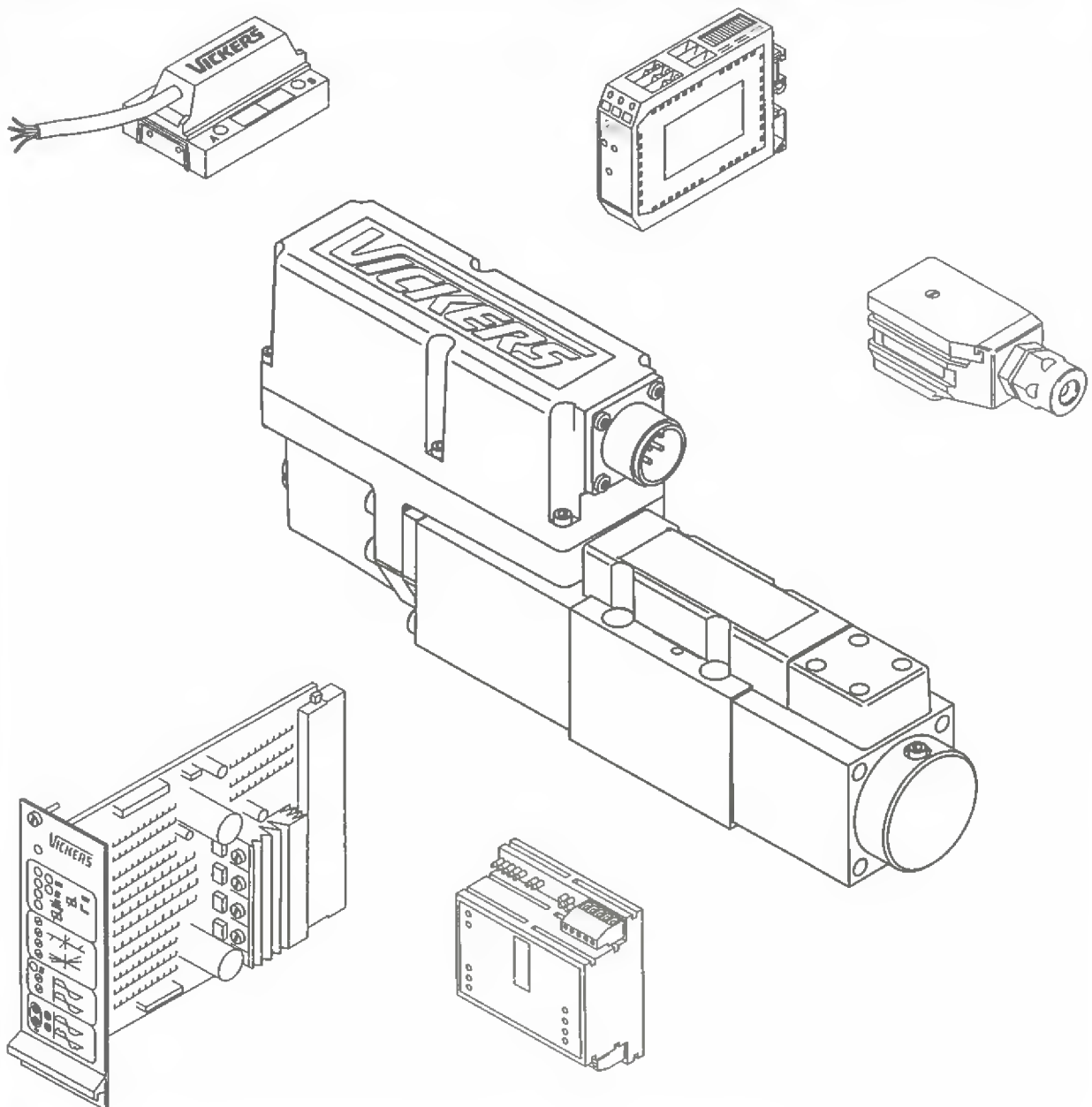
## Electrohydraulic Controls: Electronics – Section C

	Catalog Number	Page Number
EMA amplifier for EMV-611e-100/160 Electro-hydraulic Mobile Control Valve, see <b>Proportional Valves</b> section		
Installation Wiring Practices	GB 2468A	C.1
EBA TEQ 706 A, 1* Design	GB 2315	C.158
EEA AMP 451 A, 1* Design	GB 2095A	C.90
EEA LIM 454 A, 1* Design	GB 2098A	C.94
EEA DSG 450 A, 1* Design	GB 2094A	C.88
EEA-PAM-5**-A-32	GB 2464	C.34
EEA PAM 5** B, 32 Design	GB 2472	C.46
EEA PAM 5** C, 32 Design	GB 2473	C.52
EEA PAM 5** D, 32 Design	GB 2474A	C.58
EEA PAM 5** E, 32 Design	GB 2475	C.66
EEA PAM 5** F, 32 Design	GB 2476A	C.72
EEA-PAM-513-A-14	GB 2137C	C.30
EEA PAM 520/525 A, 1* Design	GB 2270A	C.79
EEA PAM 561/568 A, 1* Design	GB 2101A	C.83
EEA-PAM-571-A-14	5103.00/EN/0897/A	C.42
EEA REL 452 A, 1* Design	GB 2096A	C.92
EHA-CON-201-A, 20 Design	GB 2410B	C.96
EHA-PAM 291 A, 20 Design	GB 2093A	C.117
EHA-PID-201-A, 20 Design	GB 2427	C.110
EHA-PSU-704-*, 20 Design	GB 2419	C.153
EHA-RMP/PSU-201-A, 20 Design	GB 2410B	C.96
EHA TEQ 700 A, 20 Design	GB 2462	C.155
EHD AMP 73*, 10 Design	GB 2448A	C.23
EHD BUS 44* * 10	GB 2366	C.12
EHD-DSG-201-A, 10 Design	GB 2470	C.104
EHH-AMP-702-A, 20 Design	GB 2122D	C.120
EHH-AMP-702-C, 20 Design	GB 2114C	C.125
EHH-AMP-702-D/J/K, 20 Design	GB 2115E	C.132
EHH-AMP-712-D/G, 20 Design	GB 2282C	C.139
EHH-AMP-724-***, 1* Design	GB 2367C	C.146
KDGMA 3/5	GB 2459	C.160
KDGMH 3/5/7/8 Hydrostats	GB 2459	C.160
Electronic Accessories	GB 2460A	C.170





## Installation Wiring Practices for Vickers Electronic Products



GB 2468A



# Installation Requirements

## Introduction

Vickers Electronic Products are designed to be used in conjunction with the appropriate Vickers hydraulic valves.

A recent addition to the relevant global standards is the European Electromagnetic Compatibility Directive (EMC) 89/336/EEC, amended by 91/263/EEC, 92/31/EEC and 93/68/EEC, article 5.

All individual components which are identified by the CE logo in the relevant catalog leaflets have been developed to pass the tests required by the above directive and are qualified to bear the CE logo. However it is necessary, when they are installed in any application, that the total assembly also passes the required

tests. To ensure that this is achieved it is necessary to pay particular attention to the interconnecting wiring and shielding.

The purpose of this leaflet is to recommend basic information that has been found beneficial for general purpose installations. It is not intended to be a definitive statement which will completely satisfy all applications – such a document is not possible. The information contained in this document should ideally be used by qualified machine designers and control engineers when specifying and preparing the detailed circuit diagrams necessary for building machines.

The recommendations are suitable for use in a normal light industrial

environment. Where the installation is subject to high electromagnetic radiation from nearby electrical equipment or from fixed or mobile/portable radio transmitters, then extra precautions may need to be taken to ensure that valves are not affected by these external forces. If the offending power source(s) cannot be kept far enough away from the valves and cabling to prevent interference, then valve control cables may have to be routed in suitable metal conduit or trunking which is separately grounded.

**Thorough testing of all new installations should always be undertaken to ensure that the system is not affected by interference from external electromagnetic radiation.**

## Scope

The Vickers products covered in this leaflet are as follows, but the information may also be found useful for others not listed here.

Product	Wiring Diagrams Figure	Page
EEA-PAM-5**-*-32 Eurocard amplifiers	1 and 2	C.5 and C.6
EHH-AMP-702-*-20 Power plugs	3	C.7
EHH-AMP-712-*-20 Power plugs	3	C.7
EHH-AMP-724-*-10 Uniplug connector	–	–
KA Series valves with integral amplifiers	4 and 5	C.8
KB Series valves with integral amplifiers	4 and 5	C.8
EHA-CON-201-A-20 Converter module	6	C.9
EHA-RMP-201-A-20 Ramp generator module	7	C.9
EHA-PSU-201-A-10 Power supply module	8	C.10
EHA-PID-201-A-20 PID control module	9	C.10
EHD-DSG-201-A-10 Demand signal generator module	10	C.11

## Eurocards

The Eurocard amplifiers are used with a variety of valves. They have to be plugged into either an edge connector or a card holder, both of which can be supplied by Vickers. Connection details for the various types of valve are shown in figures 1 and 2. All cables connected to the valves need to be screened.

The solenoid cable screen should be connected to the machine protective ground point only at the electrical panel end remote from the valve.

The screen for the LVDT wires needs to be grounded at both ends to machine protective ground connections.

In difficult cases where the ground loops created by this method become a problem, then double screened cables can be used with one screen grounded at the valve end and the other screen grounded at the amplifier end of the cable.

Command signal cables should be screened as shown in figure 2.

### Cables

Three core cable  $\geq 0,5 \text{ mm}^2$  (20 AWG) with an overall screen should be used for the LVDT wiring.

Two core cable with an overall screen should be used for the solenoids.

## Power Plugs

Power plugs can be used for all of the non-feedback valves in the Vickers proportional valve range. It is necessary for good reliable operation to screen the cables as shown in figure 3. A single overall screen is usually adequate and it should be connected to an efficient protective ground point at the electrical panel end. The D and J versions have differential voltage inputs giving the facility to work with positive or negative command signals. This feature also enables two plugs to be connected "back to back" so that two solenoids can be controlled alternately from one bi-polar (+/-) command signal. The various connection options are shown in figure 3 along with details of the necessary wire end preparation.

### Cables

Cable sizes between  $0,5 \text{ mm}^2$  and  $1,0 \text{ mm}^2$  (20-17 AWG) are suitable.

## Uniplugs

The UNIPLUGs are used with suitable Cetop 3 size directional and proportional valves and are supplied with a length of cable molded into the housing. The C and D versions are for use with proportional valves and the cables for these have an overall screen. The screen should always be connected at the electrical panel to an efficient ground point.



### WARNING

Care should be taken when wiring the UNIPLUG to ensure that the correct solenoid "A" or "B" is energized when commanded. When fitting the UNIPLUG to the valve it is absolutely vital that it is fitted the correct way round with the "A" channel adjacent to the "A" solenoid. Failure to do this would cause the valve to operate in reverse and could result in serious injury.

## Valves with Integral Amplifiers

Vickers valves with integral amplifiers are fitted with 7-pin connectors and all the connections to the valve are made through them. Figures 4 and 5 show the recommended electrical connection scheme for a KB type valve and the following information should be used when wiring the valves.

1) It is important to interconnect the 0V lines as shown in figures 4 and 5.

2) The multi-core cable should have at least two screens such that the power and signal lines are separated. Additional screens may be used around pairs of wires if desired, as shown in fig 4 & 5. Signal lines should ideally be twisted pairs.

3) If the demand signal generator has a differential output, the common mode voltage of this output should not exceed 18 volts with respect to the 0V power.

4) To obtain an accurate position signal, the user's position monitor circuit should ideally have a differential input with an impedance of between 20 k $\Omega$  and 100 k $\Omega$  (see figure 4). If the user's position monitor circuit has only one input, this should be connected to pin F and no connection made to pin C. The latter arrangement will add some noise to the monitor signal and connecting pin C to 0V will not reduce the noise level.

5) While this scheme shows the ideal arrangement for grounding the connections to the screen, there is a possibility of induced noise in the ground loop. If such problems occur it may be possible to minimize any interference by reducing the area of the ground loop, i.e. keep the screened cable close to the grounded metalwork of the machine.

6) Figure 5 is applicable if the amplifier has the valve enable feature (PR7 type). The wire connected to the enable pin C should not run inside the screen for the signal lines.

# Products (continued)

## Note 1:

To obtain operation in conformance with the European EMC Directive, a metal shell connector must be used with the screen of the cable connected to the shell of the connector. The metal shell and its threaded mating ring must have an electrically conducting finish. The cable must have at least two screens as described above and the user's electronics must be adequately screened or provided with a suitable enclosure.

## Note 2:

If using a plastic connector, the system may not conform to the European EMC Directive. However, system immunity will be improved if the screen of the cable is connected to pin G as shown in figures 4 and 5.

## Note 3:

For all new design (\*) amplifiers the pin C may be connected to 0V without risk of excessive currents in the signal lines, but this is not recommended. For older design KA amplifiers or KB type PC7 and PE7 amplifiers, pin C may be used with pin F as shown in figure 4 but should not be connected to 0V.

(\*) The new amplifier is shown on the front page of this leaflet and is fitted to the following models:

KBFD/TG4V-3/5-1\*, KBSDG4V-3/5-1\* and KBHDG5V-5/7/8-1\*.

These models supersede the equivalent KA versions.

## Snap-on Modules

The Vickers range of snap-on modules is used to provide various features for command signals. The connecting cables are vulnerable to outside interference from adjacent electro-magnetic devices and so need to be screened for protection. When used with KA valves with integral amplifiers, the wiring details should be as shown in figures 6, 7 and 8. If the modules are used with other devices then the command signal cables should be screened and the screens should be grounded at one end only to an efficient ground point.

### Cables

Cable sizes from 0,5 to 2,5 mm<sup>2</sup> (20-12 AWG) are suitable.

## Power Supplies

The recommended DC power supplies for all the preceding units are the Vickers EHA-PSU-704-A-20 Series 24 volt units. These units conform to the following specifications:

IEC 364-4-41, HD 384-4-41 and VDE 0100 Part 410

These specifications require a built-in screen between the primary and secondary windings which should be connected to a protective ground connection.

If a PWM stabilized power supply with current limiting is used, the limit should be set higher than the required start-up inrush current.

## General Information

The wrapped foil type of screened cable is not recommended and the close braided type will be found to give better results.

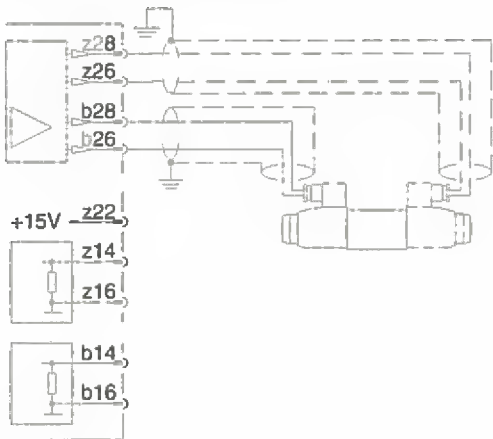
## Ground Connections

All screens should be connected to a "protective ground" which should be the ground point of the electrical panel and the framework of the machine.

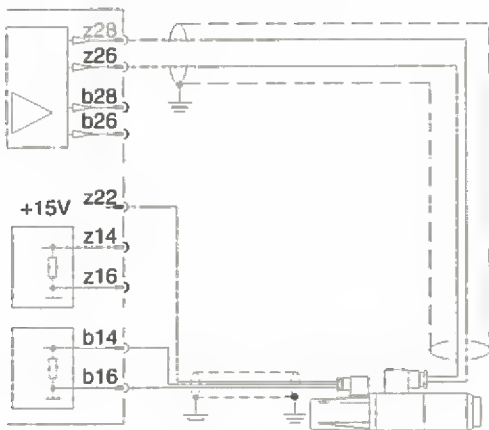
# Wiring Connections for Eurocard Amplifiers

## Amplifier Models (Typical Valve Types)

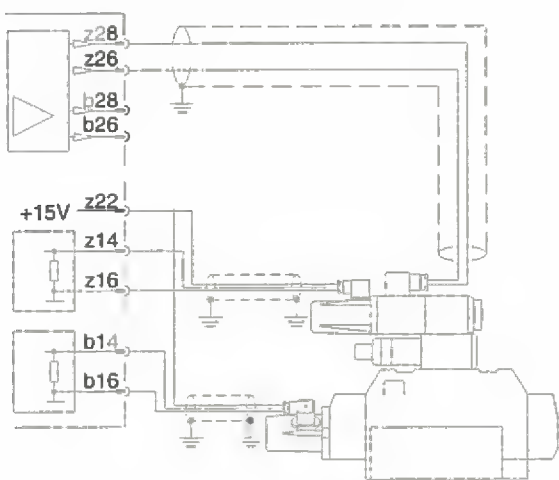
**Amplifier Models: 513, 523, 525**  
 (KD/TG4V-3/5, KCG-3/6/8, KDG5V, KX(C)G-6/8)



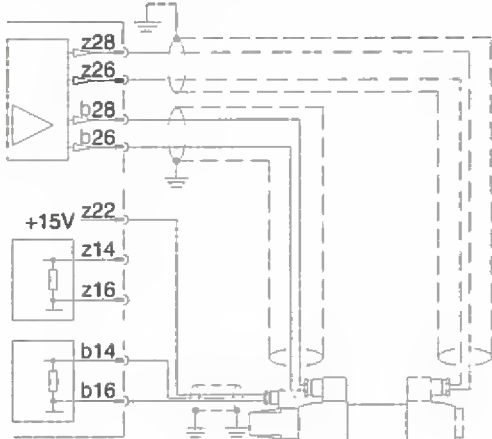
**Amplifier Model: 553 (KSDG4V-3)**



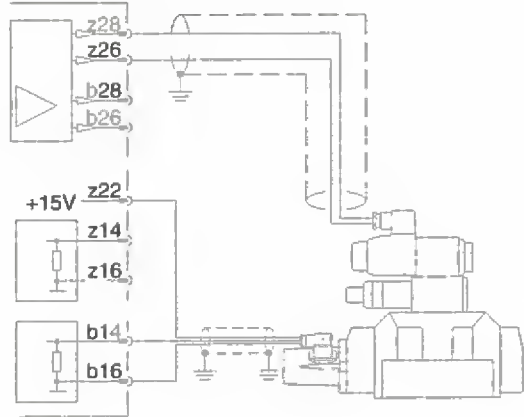
**Amplifier Models: 541, 581 (KH DG5V)**



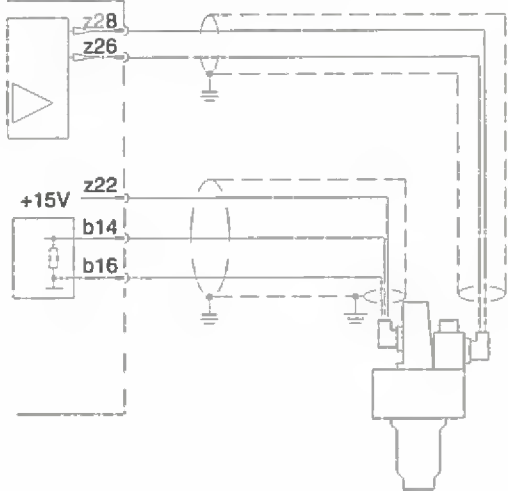
**Amplifier Models: 533, 535 (KFD/TG4V-3/5)**



**Amplifier Models: 561, 568 (KFDG5V)**



**Amplifier Model: 571 (CVU-\*\*-EFP1)**



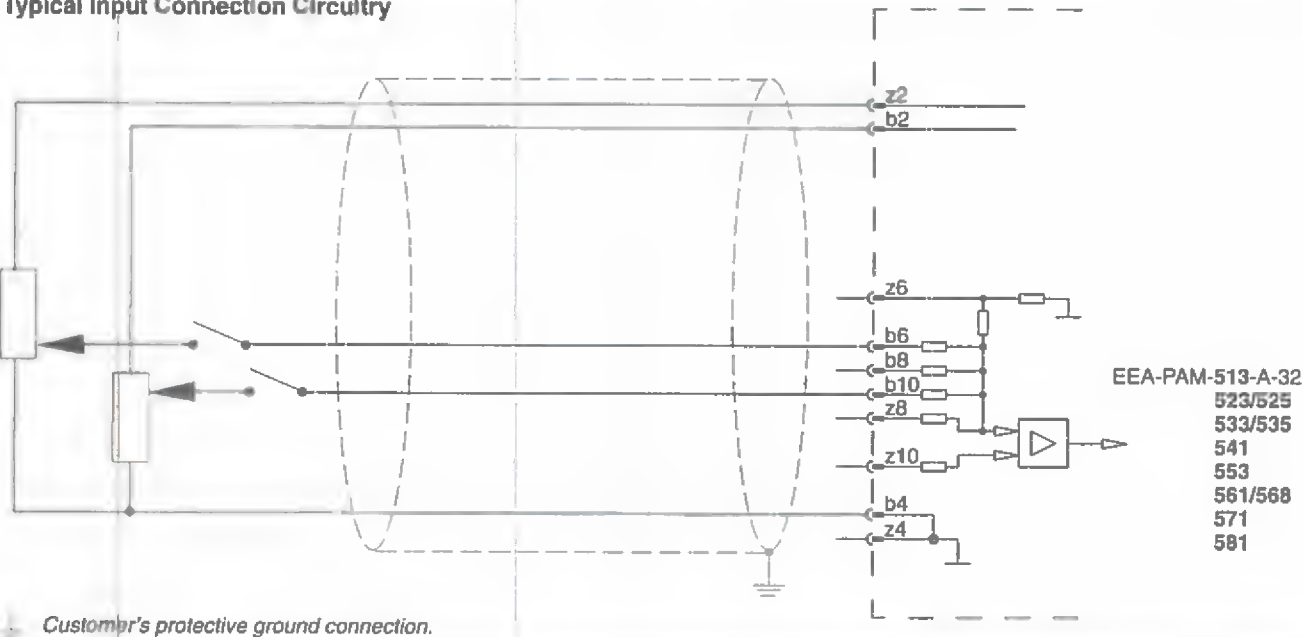
1 Customer's protective ground connection.

Figure 1

See product information on page C.3.

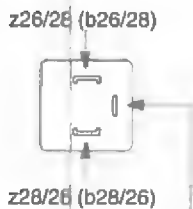
# Wiring Connections for Eurocard Amplifiers (continued)

## Typical Input Connection Circuitry



## Valve Solenoid Connections

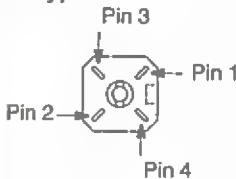
Note: Connection not polarity sensitive.



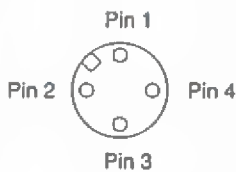
Protective ground: Connection not required if power supply conforms to VDE 0551/EN 60742/IEC 742

## LVDT Connections

### M and E Type



### B Type



	LVDT plug pin	Amplifier pin
Pilot stage	1	z14
	2	z22
	3	z16
	4	Not connected
Main stage → CVU-EFP1	1	b14
	2	z22
	3	b16
	4	Not connected

Figure 2

See product information on page C.3.



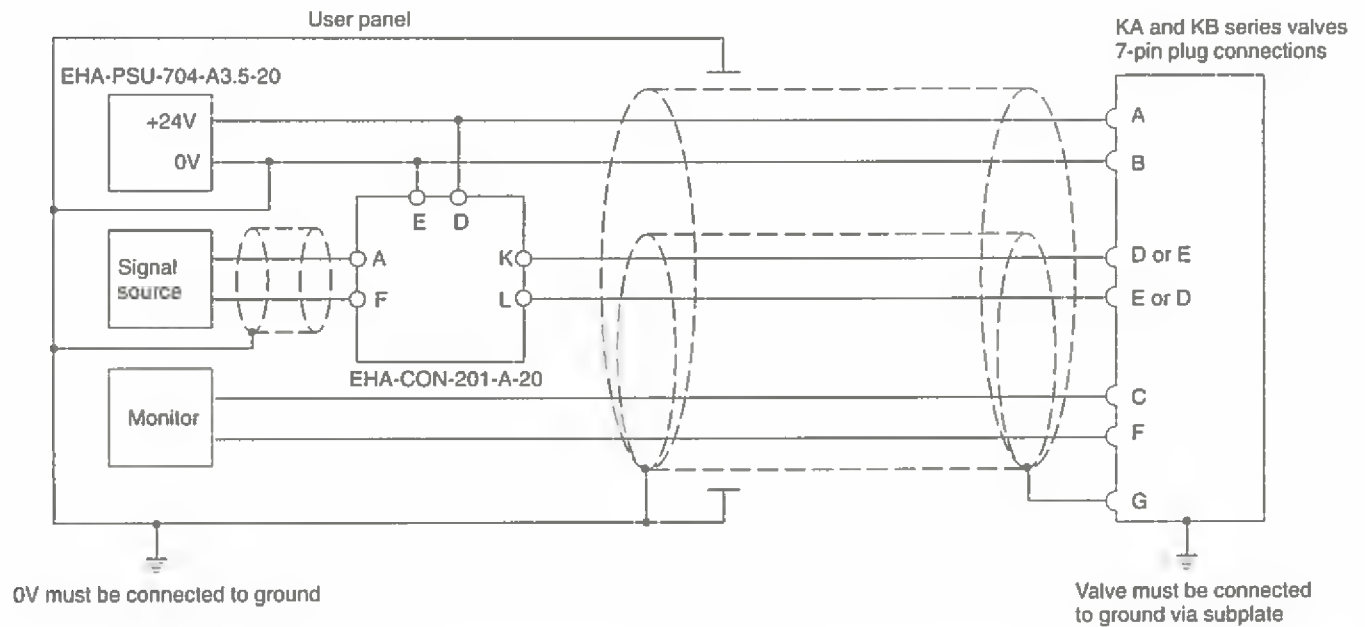
## Electromagnetic Compatibility (EMC)

### Notes for Wiring

- 1) Screened cables should be used for the command signals, the solenoid connections and the LVDT connections.
- 2) Particular attention should be paid to the grounding of the screens as shown in the diagrams.
- 3) The screen on the LVDT cable needs to be grounded at both ends. An alternative method to prevent creating earth loops is to use double screened cable with each screen grounded at opposite ends.
- 4) The amplifiers should be mounted in a metal enclosure which is connected to an efficient ground point.

# Wiring Connections for Snap-on Modules used with “KA” and “KB” Valves

Typical Connection Arrangement for EHA-CON-201-A-20

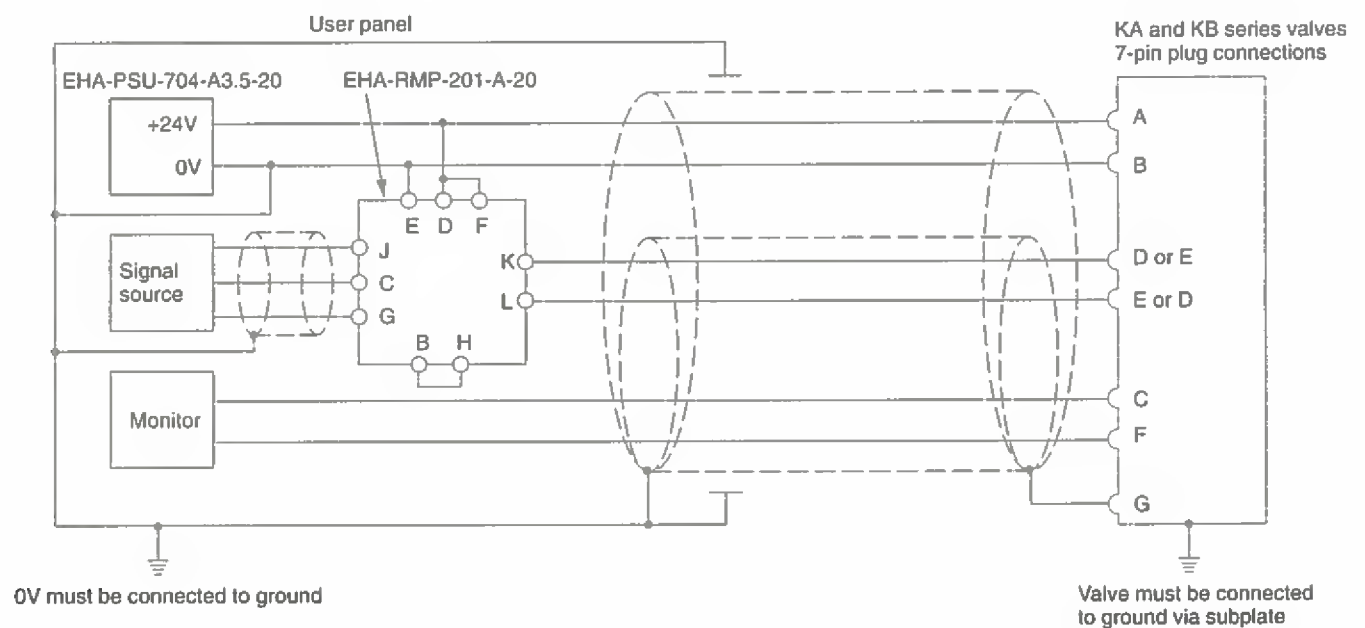


Customer's protective ground connection.

Figure 6

See product information on page C.4.

Typical Connection Arrangement for EHA-RMP-201-A-20



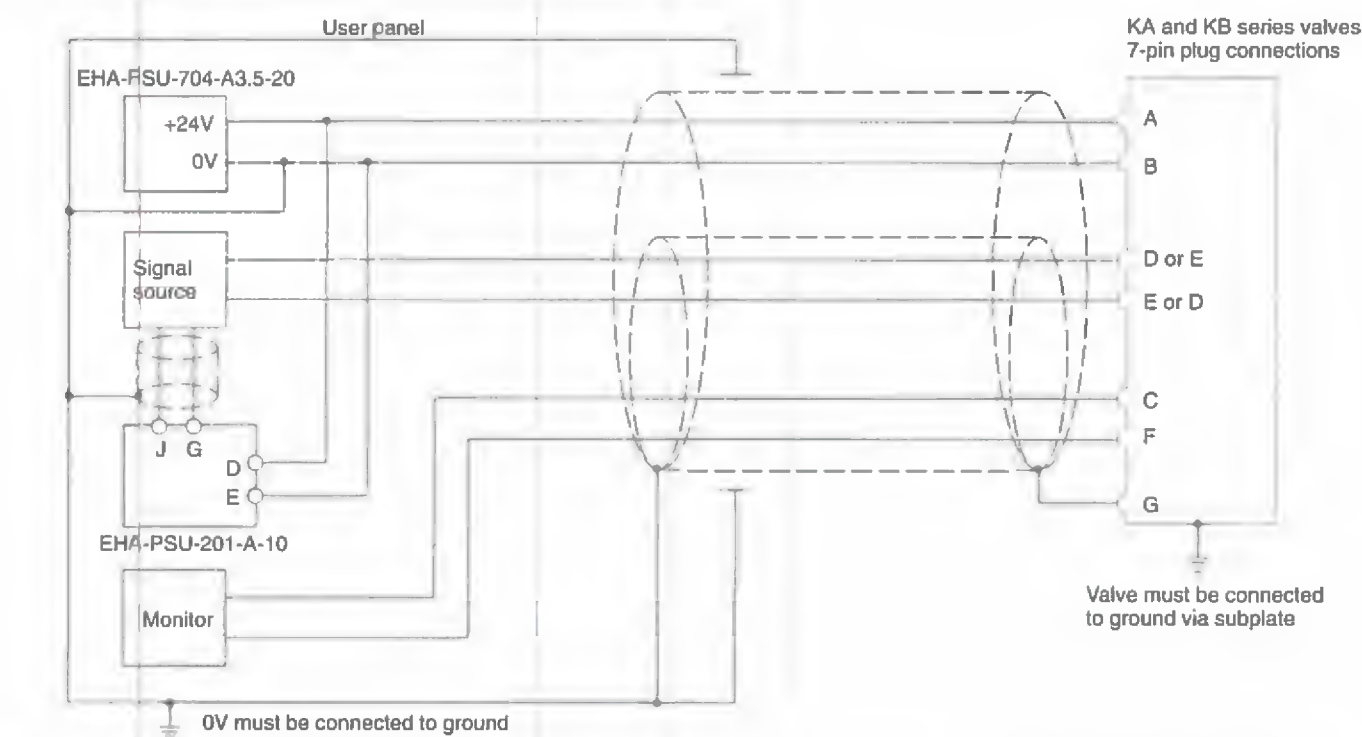
Customer's protective ground connection.

Figure 7

See product information on page C.4.

# Wiring Connections for Snap-on Modules used with “KA” and “KB” Valves (continued)

Typical Connection Arrangement for EHA-PSU-201-A-10

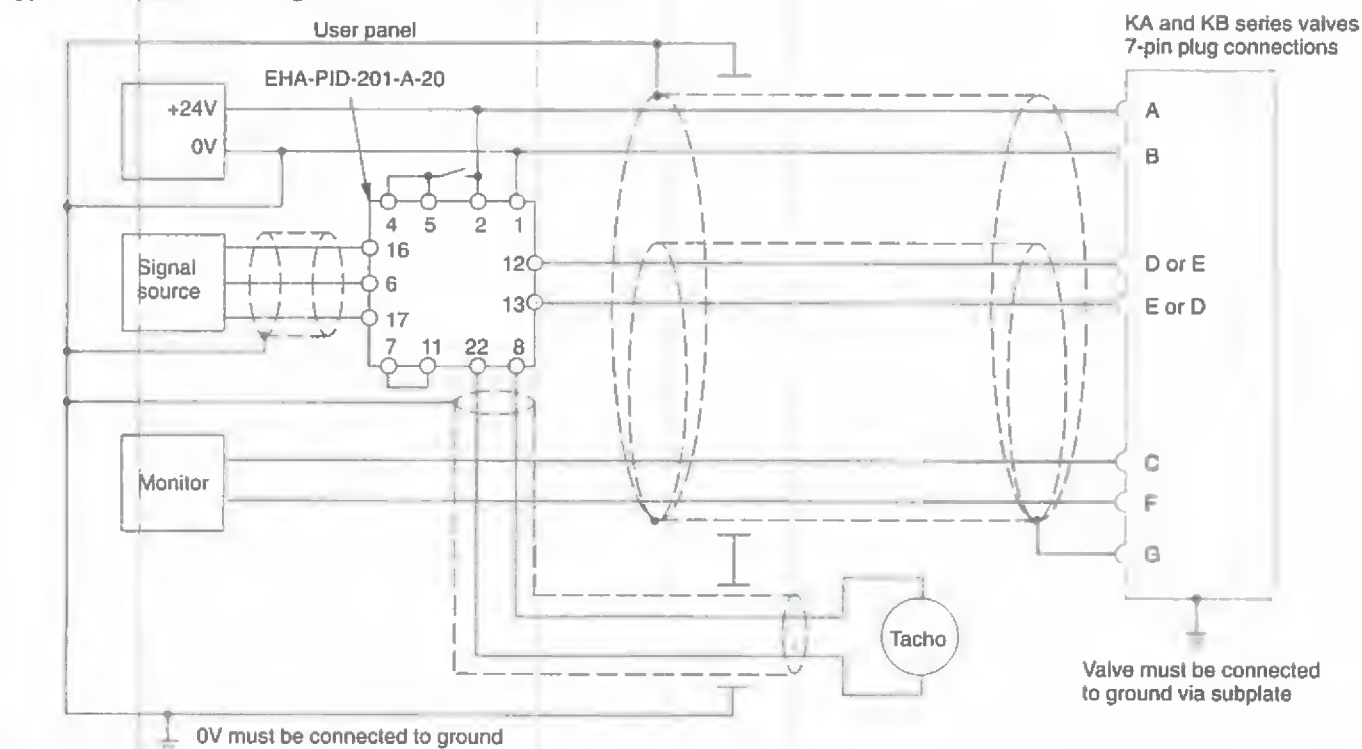


Customer's protective ground connection.

Figure 8

See product information on page C.4.

Typical Connection Arrangement for EHA-PID-201-A-20



Customer's protective ground connection.

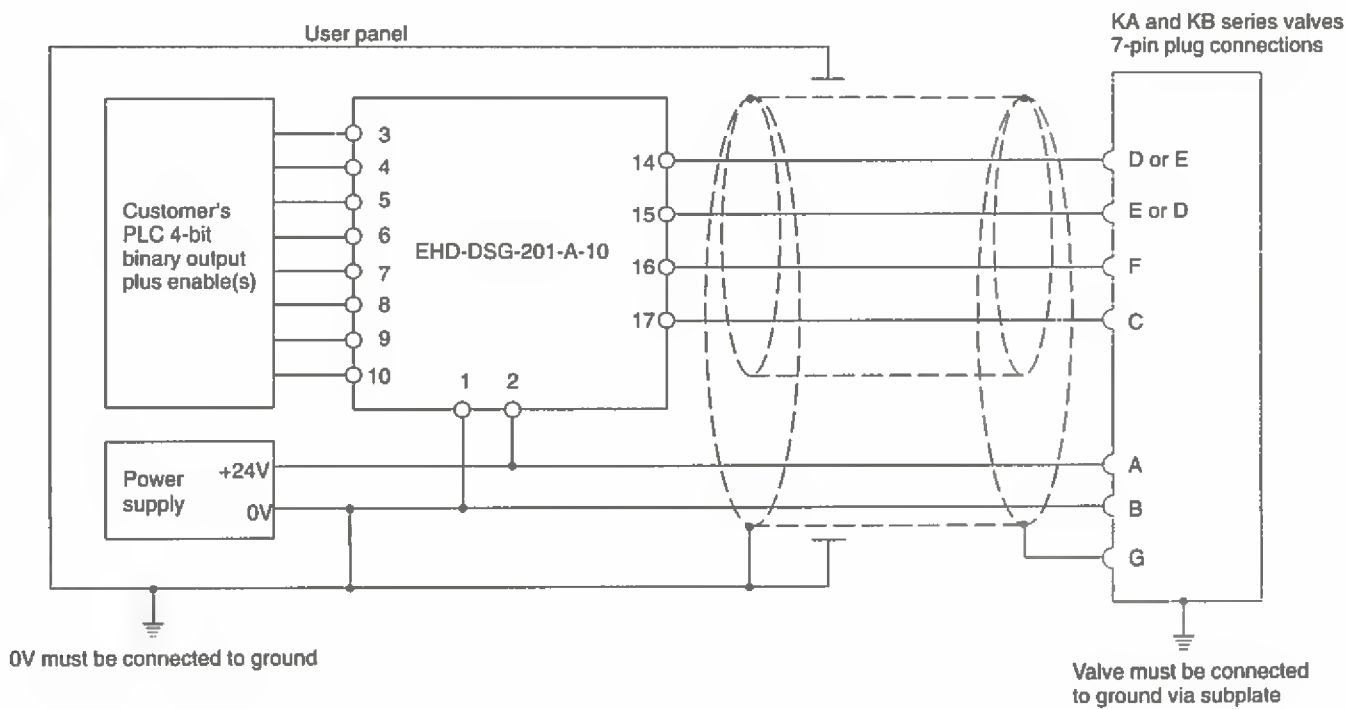
Figure 9

See product information on page C.4.



# Wiring Connections for Snap-on Modules used with “KA” and “KB” Valves (continued)

Typical Connection Arrangement for EHD-DSG-201-A-10



 Customer's protective ground connection.

Figure 10

See product information on page C.4.

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## Fieldbuses Supported

### PROFIBUS

The PROFIBUS is a standard open-systems fieldbus to DIN 19245, Parts 1 and 2, and supports the ISO/OSI model up to Layer 7. It permits multi-master and single-master operation. User-friendly bus access via Layer 7 allows even complex equipment to be connected. This fieldbus provides transparent MAP data transmission for CIM applications.

Max. transmission rate	500 kbit/s
Max. bus length	1200m up to 93,5 kbit 200m for 500 kbit without repeater 3600m for 93,5 kbit with repeater
Transmission method	RS485
Cable	Twisted pair 24 AWG
Max. number of users	32 without repeater / 122 with repeaters

### Sinec L2-DP

The Siemens Sinec L2-DP is used as a sensor-actuator bus for connecting decentralized peripherals to the PLC modules. It conforms to ET200 and is now supported by a large number of manufacturers.

Max. transmission rate	1500 kbit/s
Max. bus length	1200m up to 93,5 kbit 120m for 1500 kbit without repeater 3600m for 93,5 kbit with repeater
Transmission method	RS485
Cable	Twisted pair 24 AWG
Max. number of users	32 without repeater / 122 with repeaters

### Interbus-S

The Interbus-S is a sensor-actuator bus from Phoenix Contact, Blomberg. It is now widely used as a high-speed single-master bus for up to 4096 digital inputs and outputs. It is exceptionally easy to operate. All major PLC and computer systems are supported.

Transmission rate	300 kbit/s
Max. bus length	12000m
Transmission method	RS485
Cable	Twisted 6-conductor (long-distance bus)
Wire type	LI-YCY, 3 x 2 x 0,25 mm
Max. number of users	256
Fieldbus connector	RC-09 P 1 N O**
Fieldbus coupling	RC-09 S 1 N O**

### Model Code

**EHD-BUS** -\*\*\* -\* \*\* -\*\*



#### 1 Fieldbus system type

440 = PROFIBUS

441 = Sinec L2-DP

442 = Phoenix Interbus-S

#### 2 Valve cabling connection type

A = Screw terminals, input and output  
Pg threads closed by plugs

B = Screw terminals via Pg fittings

C = M12 miniature connector (plugs  
not supplied)

#### 3 Maximum number of valves in node

06 = 6 directional valves, each with  
two solenoids

10 = 10 directional valves, each with  
two solenoids

14 = 14 directional valves, each with  
two solenoids

6A = 6 directional valves, each with  
two solenoids, plus two  
bi-directional proportional valves.

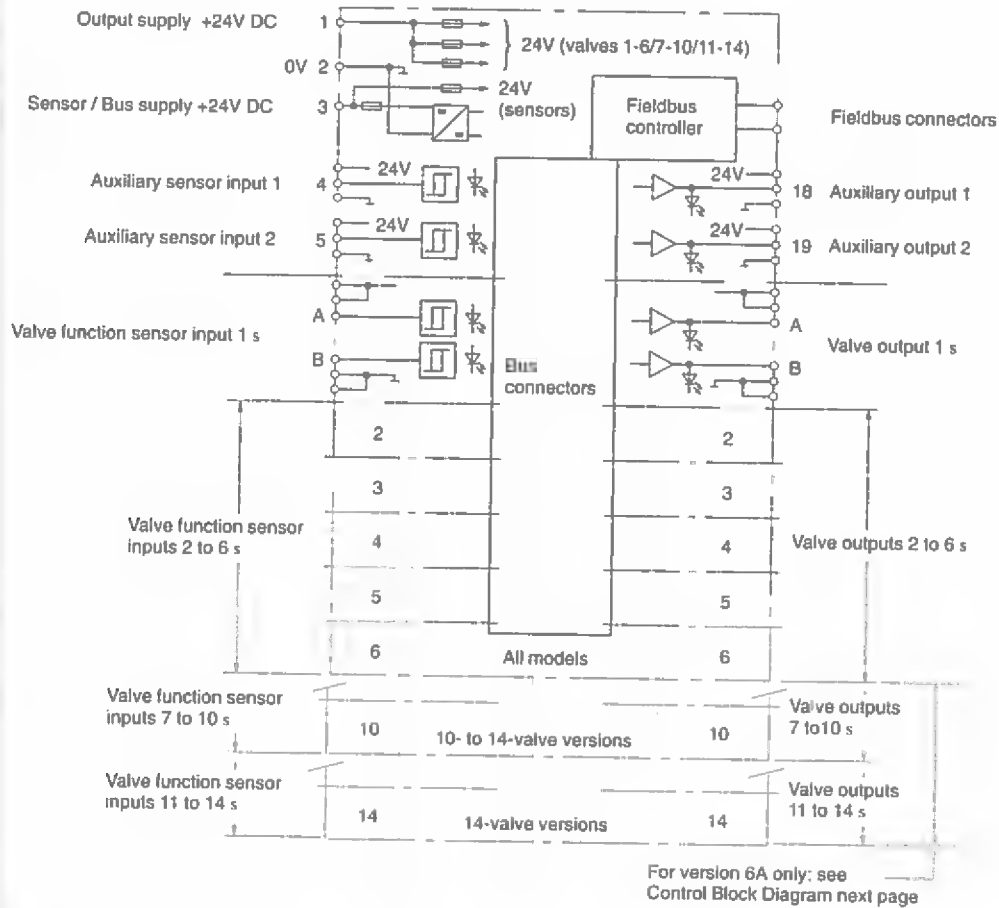
#### 4 Design number

Types 06, 10 and 14: 1\* design

Type 6A: 2\* design

Subject to change. Installation  
dimension unchanged for design  
numbers 10 to 19, and 20 to 29  
respectively

## Electrical Block Diagram



### s Terminal numbers: Versions A and B

Position	Terminal number: Sensor input		Valve output		Position	Terminal number: Sensor input		Valve output		Position	Terminal number: Sensor input		Valve output	
	A	B	A	B		A	B	A	B		A	B	A	B
1 to 6: All model types					7 to 10: 10- and 14-valve versions					11 to 14: 14-valve version				
1	6	7	20	21	7	32	33	40	41	11	48	49	56	57
2	8	9	22	23	8	34	35	42	43	12	50	51	58	59
3	10	11	24	25	9	36	37	44	45	13	52	53	60	61
4	12	13	26	27	10	38	39	46	47	14	54	55	62	63
5	14	15	28	29										
6	16	17	30	31										



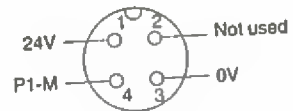
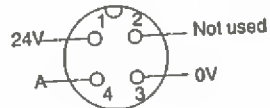
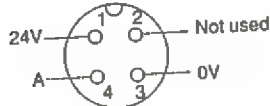
### WARNING: Electromagnetic Compatibility (EMC)

It is necessary to ensure that the unit is wired up in accordance with the connection arrangements shown in this leaflet. For effective protection the user's electrical cabinet, the valve subplate or manifold and the cable screens should be connected to efficient ground points. The metal 7 pin connector part no. 934939 should be used for the integral amplifier.

In all cases both valve and cable should be kept as far away as possible from any sources of electromagnetic radiation such as cables carrying heavy current, relays and certain kinds of portable radio transmitters, etc. Difficult environments could mean that extra screening may be necessary to avoid the interference.

## Connections: Version C

Top row



Bottom row

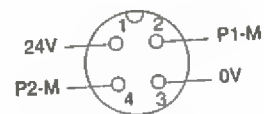
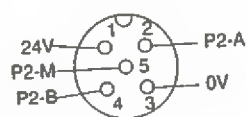
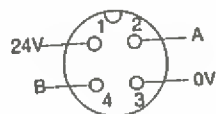
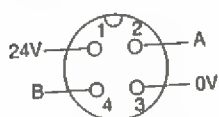


Fig. 1. Inputs to sensors

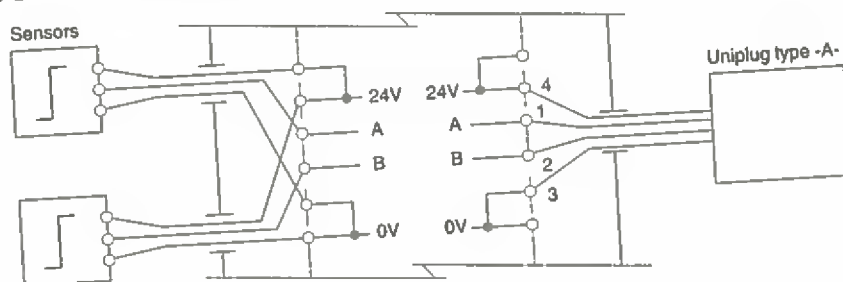
Fig. 2. Outputs to switching valves

Fig. 3. Outputs to proportional valves

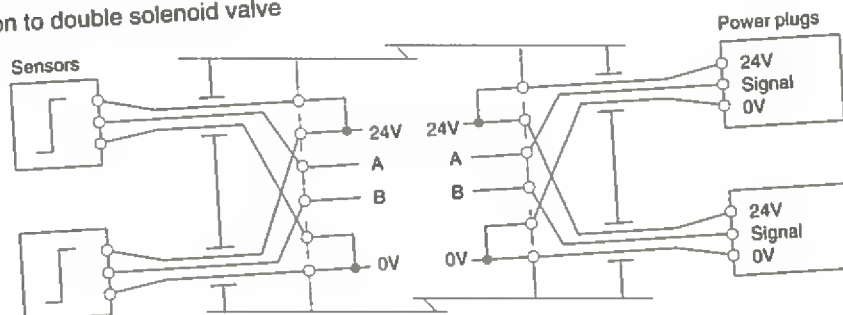
Fig. 4. Monitor inputs

## Typical Connections

Uniplug connection to double solenoid valve



Power plug connection to double solenoid valve



## Connection Sizes

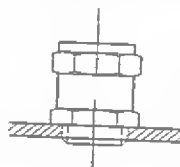
Type A



Type A: Pg threads closed by plugs

Connection	Thread size
Valve outputs	Pg9
Valve function sensors	Pg9
Auxiliary sensors	Pg9
Auxiliary outputs	Pg9

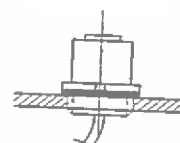
Type B



Type B: Cable glands

Connection	Thread size	Cable size, dia, mm
Valve outputs	Pg9	6-9
Valve function sensors	Pg9	6-9
Auxiliary sensors	Pg9	6-9
Auxiliary outputs	Pg9	6-9

Type C



Type C: M12 round connectors

Connection	Connector size
Valve outputs	M12 round connector, 4 pin
Valve function sensors	
Auxiliary sensors	
Auxiliary outputs	
Proportional valve output	M12 round connector, 5 pin

## Accessories

### 24V DC connectors for switching valve, DG4V-3(S), 60 design

For normal switching Power plug type	EHH-AMP-702-A-20
UNIPLUG type	EHH-AMP-724-A**-10

### Connectors for proportional valves, KDG4V-3(S), 60 design

For "Soft Switching" Power plug type	EHH-AMP-702-C/F-10
UNIPLUG type	EHH-AMP-724-C**-10
Power plug type	EHH-AMP-702-D/E-10
UNIPLUG type	EHH-AMP-724-D**-10

### Miniature round connectors for Profibus and Sinec L2-DP

Order part no.	02-104662
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### M12 Connectors for C version

Inputs/outputs	C-version 4-pin	Order part no.	02-104777
Proportional valve outputs	C-version 5-pin	Order part no.	02-104778

### Manuals available to order

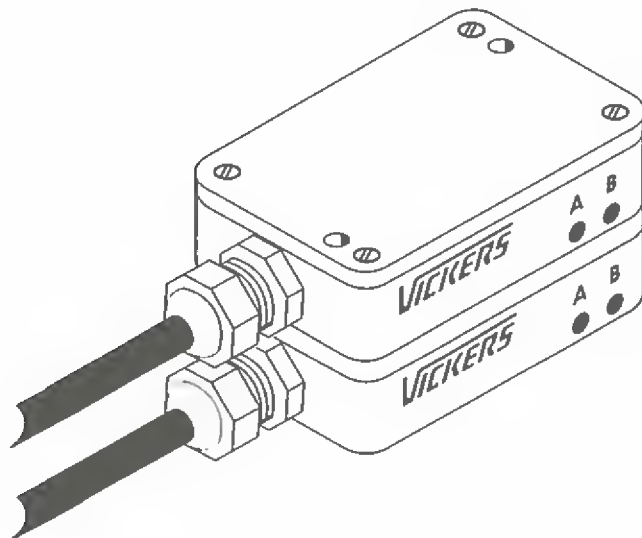
Profibus	German language	Publication no.	02-104667
Profibus	English language	Publication no.	02-104668
Sinec L2DP	German language	Publication no.	02-104669
Sinec L2DP	English language	Publication no.	02-104670
Interbus S	German language	Publication no.	02-104671
Interbus S	English language	Publication no.	02-104672

### Additionally required manual for proportional version 6A

German language	Publication no.	02-104775
English language	Publication no.	02-104776

## Mobile Open Loop Amplifier

EHD-AMP-73\*-\*\*\*-1\*



- The basic amplifier is an analog device that uses state of the art digital technology.
- A diecast aluminium case is used for the weatherproof housing and multiple amplifiers can be stacked to form one easily mountable assembly.
- A proportional version, featuring cable break detection, is available for use with a joystick.
- A softswitch version is offered for use with switched inputs. In conjunction with a Vickers CMX valve this amplifier can provide a "float condition" for attached actuators.
- The amplifier design is adaptable to specific OEM requirements should these not be covered in the basic specification.

### General Description

This product has been designed to provide manufacturers of mobile and industrial equipment with a modern, inexpensive and robust electronic amplifier suitable for driving most non-feedback proportional valves. These include the following Vickers valves:


KTG4V-3 and  
KTG4V-5 ..... Throttle valves  
EPV 16 ..... Valvistor® throttle valves  
EPFR1-10 and  
EPFR1-16 ..... Flow control valves

KDG4V-3 and  
KDG4V-5 ..... Directional valves  
KDG5V-5, KDG5V-7  
and KDG5V-8 ..... Directional valves  
CMX 100 and  
CMX 160 ..... Directional valves  
KCG-3, KCG-6  
and KCG-8 ..... Relief valves  
KXG-6 and  
KXG-8 ..... Pressure reducing valves  
ERV1-10, ERV1-16  
and ERV2-10 ..... Cartridge pressure  
relief valves

### Features

- Modern digital power technology with low heat generation.
- Environmental protection to IEC 529 IP 67 specification.
- Vibration tested as a complete unit.
- Full electromagnetic compatibility (EMC) to EN 50081-2 and EN 50082-2.
- Wide temperature range.
- Built-in diagnostics using LEDs.
- Reverse polarity and short circuit protected.
- Internal user adjustments for:
  - Gain
  - Deadband Compensation
  - Ramps
  - Dither (amplitude).
- Cable break detection for joysticks.
- Design for easy custom packaging.
- Double and single solenoid versions.
- 12 volt and 24 volt versions.



This product has been designed and tested to meet specific standards outlined in the European Electromagnetic Compatibility Directive (EMC) 89/336/EEC, amended by 91/263/EEC, 92/31/EEC and 93/68/EEC, article 5. For instructions on installation requirements to achieve effective protection levels, see this leaflet and the Installation Wiring Practices for Vickers Electronic Products leaflet 2468. Wiring practices relevant to this Directive are indicated by  Electromagnetic Compatibility (EMC).

GB-2448A



## Operation

The amplifier has outputs for two solenoids each providing pulse width modulated (PWM) current drives of up to 3.5A depending on supply voltage.

The magnitude of the output current is determined by the input command signals and the gain setting. It is maintained constant by the amplifier at the command level even though the solenoid coil resistance varies due to temperature changes.

Frequency generation for the PWM and the dither is provided by the digital circuitry at the core of the amplifier. Adjustments for gain, deadband compensation, ramps and dither are made by operating the internal potentiometers which are accessible to the user by removing the cover from the housing.

The two gain and deadband adjustments can be used to tune the amplifier to match the spool overlaps in the valves being used. Dither amplitude can also be adjusted for optimum performance in the actual application.

Ramp adjustments can be set to limit the maximum rate of change for the output currents. These are usually necessary with the switched inputs of the softswitch version but can also be effectively used to prevent rapid joystick movements producing unacceptable jumps in the outputs.

### Overloads - All Types

When operating solenoids A or B any overload is detected by the amplifier, which turns off. Removal of the fault results in the amplifier re-setting itself immediately.

### Proportional Version for Joysticks

To take advantage of the cable break safety feature, a joystick with an operating range of 5% to 95% of the total resistance should be used. The reference voltage for the joystick is provided by the amplifiers on pins 1 and 2. Any input voltage from the joystick on pin 3 which is less than 5% of  $V_{ref}$  or more than 95% of  $V_{ref}$  is treated by the amplifier as a fault condition and it will switch itself off. A cable break or short

circuit could give rise to these two conditions. Immediately the input voltage returns within the 5% to 95% range, the amplifier will continue working as normal.

An additional deadband is built into the input circuitry so that variations of  $\pm 10\%$  from the centre position do not produce any outputs. This is done to prevent small joystick movements which may be caused by vibration, etc., causing unwanted movement of the actuator.

The true input voltage operating range for solenoid B input is from 40% to 5% of  $V_{ref}$  and for solenoid A from 60% to 95%  $V_{ref}$ .

### Softswitch Version

Switched input signals at supply voltage level are used to drive the amplifier. When applying voltage to the switching inputs A or B, the solenoids A or B are energized. The current jumps to the deadband value and then rises with the set ramp time to an adjustable maximum current. When removing the voltage from the switching inputs, the current ramps down to the deadband value and then shuts off completely. Solenoid A has to be used for the raising, solenoid B for the lowering function to take advantage of a built-in safety feature (see below). It is possible to use the floating position of the CMX valve with this amplifier. The floating position is reached when applying supply voltage on both switching inputs A and B simultaneously. If one solenoid was energized before, the current in this solenoid will first be ramped down to zero. No ramp time is used to enter or leave the float position.

### Built-in Safety Features when Using the Softswitch Amplifier with CMX Valves

1. When both inputs are switched on to move the valve to the float position, solenoid B is turned on first. The amplifier then checks that current is flowing in solenoid B before turning on solenoid A. This ensures that any short output during the transition period can only divert fluid to the B port, never to the A port.

2. When the amplifier is in the float position the current in both solenoids is monitored continuously and if they vary from the preset level both outputs are turned off and the red LED is illuminated. After approximately 2 seconds the amplifier will try to re-set itself to the float position as described in 1. above.

## Diagnostics

Two LEDs are used to show the operating status of the amplifier. LED B lights up green when the supply voltage is applied. LED A and/or LED B light up yellow when solenoid A/B is energized.

LED A lights up red on joystick or cable errors.

## Installation

The following notes will be found useful when installing the amplifiers

- Use shielded cable for maximum EMI rejection.
- Connect the joystick directly to the amplifier. Do not use external ground or supply.
- If joysticks with operation range less than 5% to 95% are used (for example 25% to 75%) the gain setting can be adjusted to more than 100% to allow maximum current.
- To protect the amplifier from damage in case of a load dump, an external fuse must be used.
- To prevent the potentiometer settings from changing, it is recommended to seal the adjusting screws (e.g. Loctite Screwlock 222).

### Connections

The following cables are required and they should be 1 mm<sup>2</sup> (18 AWG) minimum.

#### Proportional Version

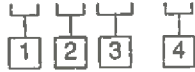
Joystick input ..... 3 leads  
Solenoid A+B ..... 2 leads  
Power supply ..... 2 leads

#### Softswitch Version

Switching inputs A+B ..... 2 leads  
Solenoid A+B ..... 2 leads  
Power supply ..... 2 leads

# Model Code

EHD - AMP - 73 \* - \* \*\* - 1\*



---

**1 Supply voltage**

0 = 24V  
1 = 12V

---

**2 Function**

C = Softswitch-switching inputs  
(double solenoids)  
D = Joystick-input (double solenoids)  
E = Joystick input (single solenoids)  
F = Softswitch (single solenoid)

---

**3 Current rating**

08 = 0,8 A (Type 730 only)  
16 = 1,6 A  
35 = 3,5 A (Type 731 only)

---

**4 Design number, 1\* series**

Subject to change. Installation  
dimensions unaltered for design  
numbers 10 to 19.

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## Technical Data

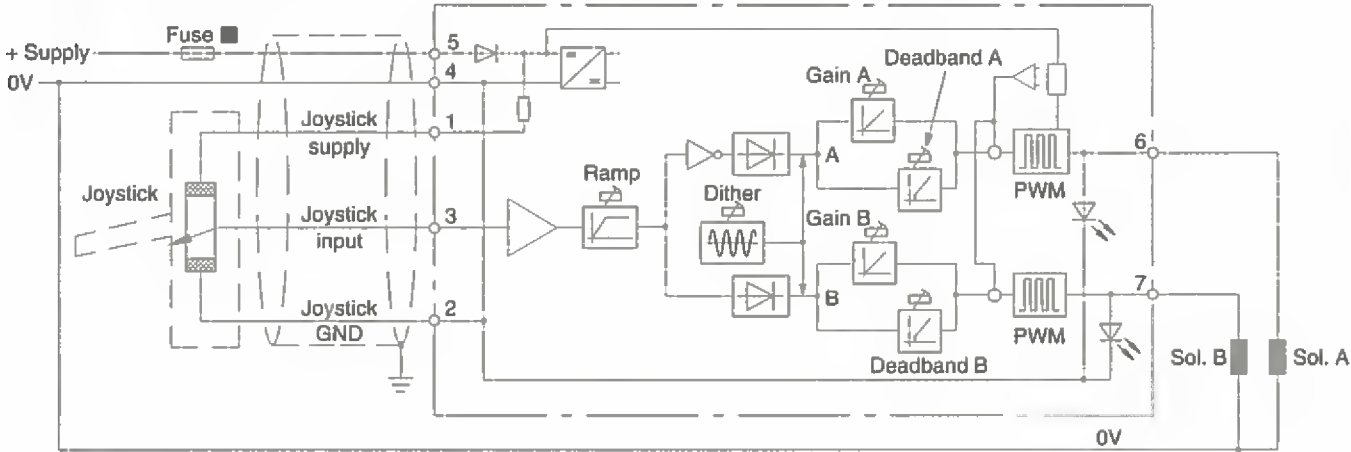
Power (input) supply	24 volt version: 19 to 32V DC including 10% ripple 24V DC nominal  12 volt version: 9 to 16V DC including 10% ripple 12V DC nominal
Load dump protection on supply voltage	150V DC x 150 Hz AC (must have external fuse fitted)
Absolute maximum voltage	72V absolute max. for less than 1,5 ms
Fuse (necessary for load dump protection)	0,8 amp rated current: 2A (fast) 1,6 amp rated current: 2A (fast) 3,5 amp rated current: 4A (fast)
Max. power consumption incl. solenoid	45W (one solenoid energized)
Reverse polarity protected	Yes
Short circuit protected	Yes
Output current per solenoid: 12V version 24V version	1,6A / 3,5A 0,8A / 1,6A
Max. output voltage: Typical, at 1,6A output current	Typically 1,5V below supply voltage
Deadband compensation (Min. A & Min. B) Trigger level	0% to 50% of max. current ± 10% of max. input command
Gain	0% to 110% of max. current
Float current	50 to 80% of max. (adjustable)
Ramp time	50 ms to 5s, for all 4 quadrants
PWM frequency	500 Hz
Dither: Frequency Amplitude	100 Hz 0 to 25% of max. current
Joystick: Resistance  Operation range	5 kΩ (0,3W max. power dissipation) 1 kΩ (1W max. power dissipation) "D" version: solenoid "A", 40% to 5%; solenoid "B", 60% to 95% "F" version: 10% to 95%
Vickers environmental specification	Class II; product for mobile market
Electromagnetic compatibility (EMC): Emission Immunity	EN-50081-2 EN-50082-2
ASAE-standard	EP455, Level 2 (pressurized cabs)
Temperature range: Operating Storage	-30 to 70°C (-22 to 158°F) -40 to 85°C (-40 to 185°F)
Cable clamp size Max. cable diameter Wire size	PG11 11 mm (0.43 in) 0,5 to 2,5 mm <sup>2</sup> (22 AWG to 12 AWG)
Mechanical vibration	0,54 mm (0.02 in): 10 to 55 Hz 5g: 55 Hz to 20 kHz
Protection class	IP 67, IEC 529
Housing material	Die cast aluminium
Size, approx.	95 x 65 x 35 mm (3.74 x 2.56 x 1.38 in)

# Electrical Block Diagrams

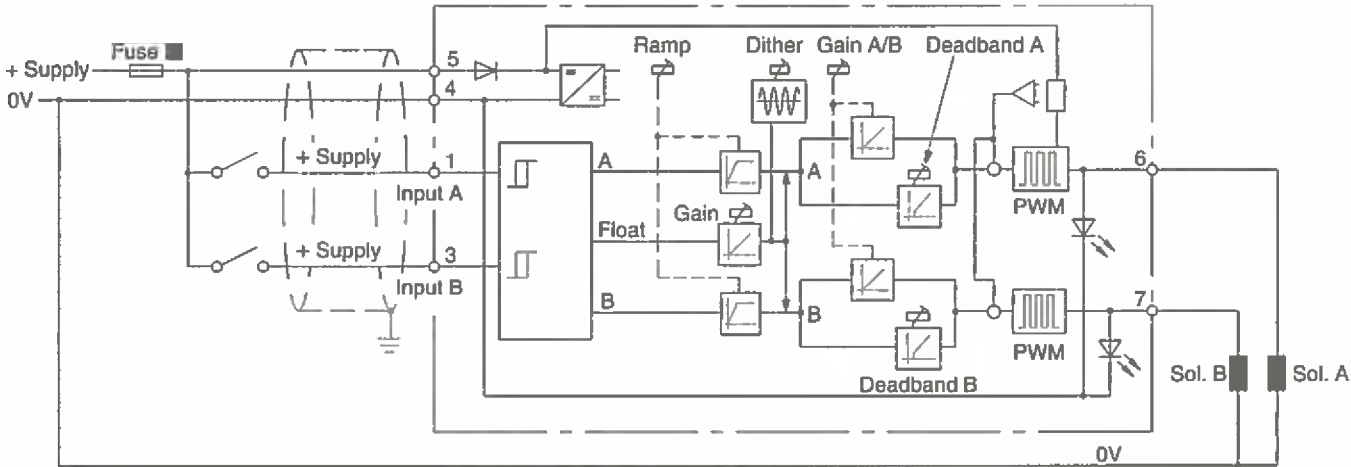
## Additional Data for Softswitch Version

Switching input voltage level 24 volt supply version	-3V to 5V 13V to 30V 5V to 13V	Off On Signal at previous level (hysteresis)
Switching input voltage level 12 volt supply version	-3V to 5V 7V to 30V 5V to 7V	Off On Signal at previous level (hysteresis)
Input modes (C version)	Input A = ON Input B = OFF Input A = OFF Input B = ON Input A = ON Input B = ON	Solenoid A operating  Solenoid B operating  Float position (CMX only)

Type EHD-AMP-73\*-D/F\*\*-10



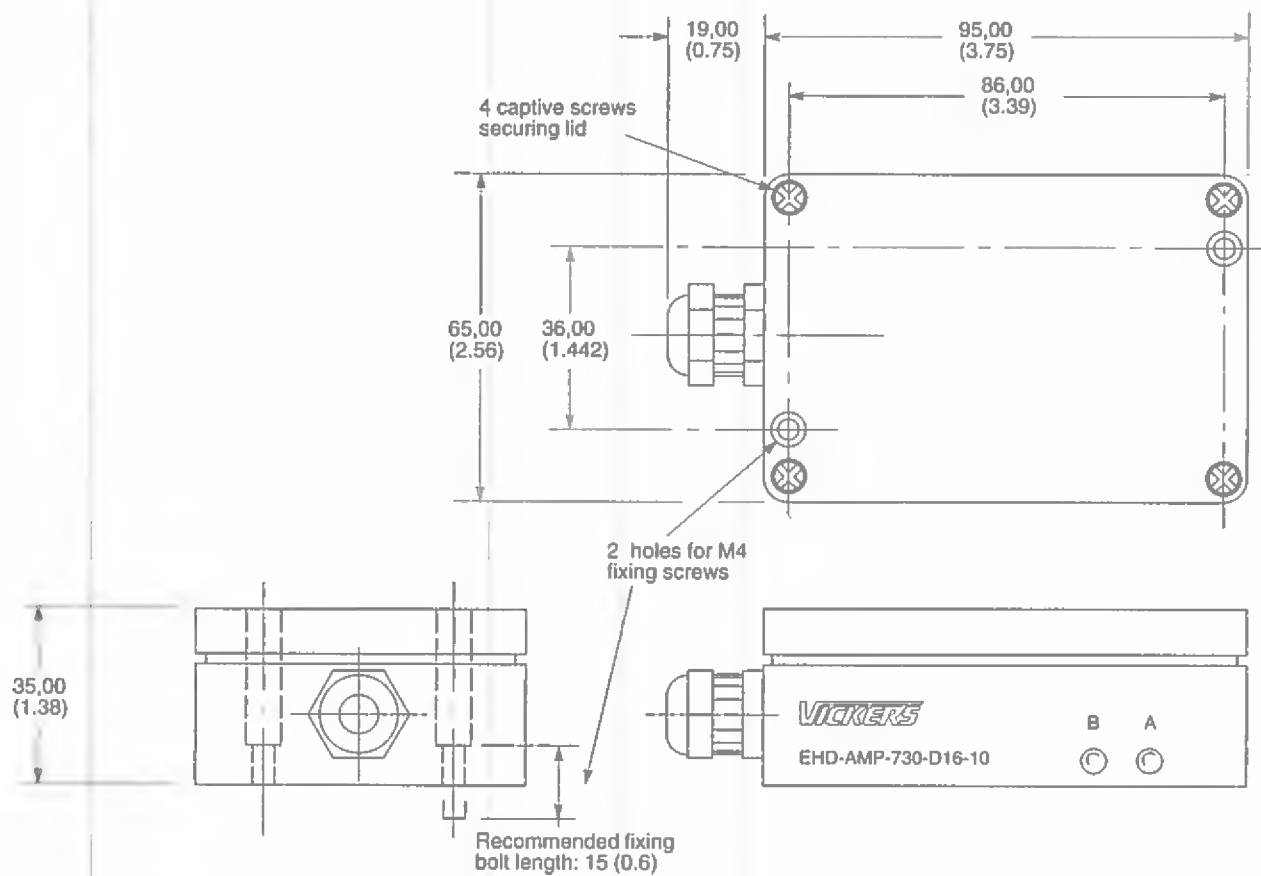
Type EHD-AMP-73\*-C/E\*\*-10



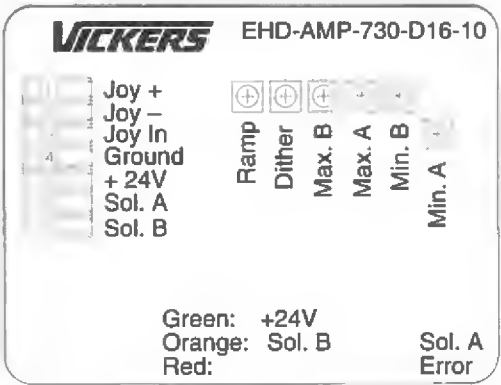
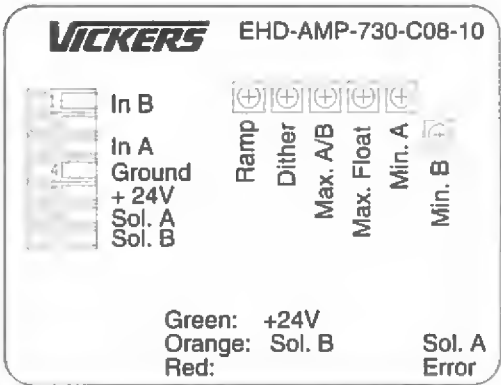
Note: Models E and F operate the "A" solenoid only. The "B" channel components are not fitted.

- Fuse, see Technical Data.
- ⏏ Chassis ground connection.

Installation Dimensions in mm (inches)



# Technical Identification and Potentiometer Locations



*Note: Models E and F operate the "A" solenoid only. The "B" channel components are not fitted.*



**Warning: Electromagnetic Compatibility (EMC)**

*It is necessary to ensure that the amplifier is wired up in accordance with the connection arrangements shown in this leaflet. For effective protection, the user's electrical enclosure, the valve subplate or manifold and the cable screens should be connected to the main chassis of the machine.*

*In all cases, valve, amplifier and cable should be kept as far away as possible from any source of electromagnetic radiation such as cables carrying heavy current, relays and certain kinds of portable radio transmitters, etc. Difficult environments could mean that extra screening may be necessary to avoid the interference.*

## Power Amplifier

Type EEA-PAM-513-A; 14 Design  
For KCG-3, 10 Series Proportional Pressure Control Valves

### General Description

The power amplifier has five voltage inputs (one inverting) and a current input for 0-20 mA. The "set minimum" and "gain" adjustments allow the amplifier to be easily tuned to the proportional pressure control valve. The ramp potentiometer on the front panel simultaneously adjusts the output acceleration and deceleration. The ramp function is normally enabled; it can be permanently disabled by an external wire link, or selectively enabled/disabled using a remotely located switch.

Monitor points on the front panel allow measurement of the conditioned command input signal (after set minimum, gain and ramp functions) and of the solenoid current. The latter is scaled to give 1 volt per ampere.

### Features

- User-friendly front panel with all the necessary adjustments, LEDs and monitor points
- Electronic overload protection with automatic reset
- Pulse width modulation for high efficiency
- Ramp function generator for control of pressure increase and decrease rates
- 24V DC power supply
- Either current or voltage input signals
- Standard input and output signals

### New 14-design Features

- Wider supply voltage range plus increased tolerance to ripple
- Low supply voltage protection
- Additional monitor points on edge connector

Gain re-positioned in circuitry to give:

- Ramp setting unaffected by gain adjustment
- Constant trigger voltage for deadband compensation

### Front Panel

#### LEDs

- [1] 24V supply voltage, green
- [2] 15V control voltage, green
- [3] Solenoid output enabled, yellow
- [4] Solenoid output overload, red
- [5] Current output to solenoid, yellow

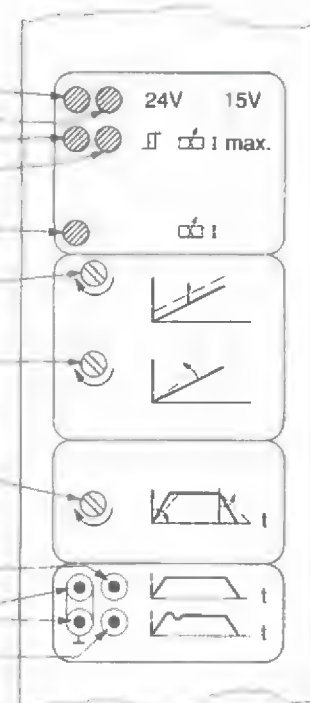
#### Potentiometers

- [6] Set minimum
- [7] Gain
- [9] Ramp setting

#### Monitor points ▲

- [11] Conditioned command signal
- [12] Common ground
- [13] Solenoid current

▲ Ø 2 (0.0787 dia.) sockets



**Warning: Electromagnetic Compatibility (EMC)**

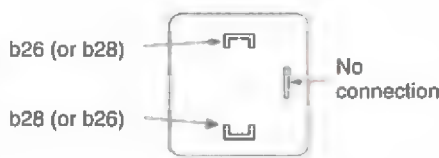
The European Community directives for electromagnetic compatibility (EMC) do not apply to this product



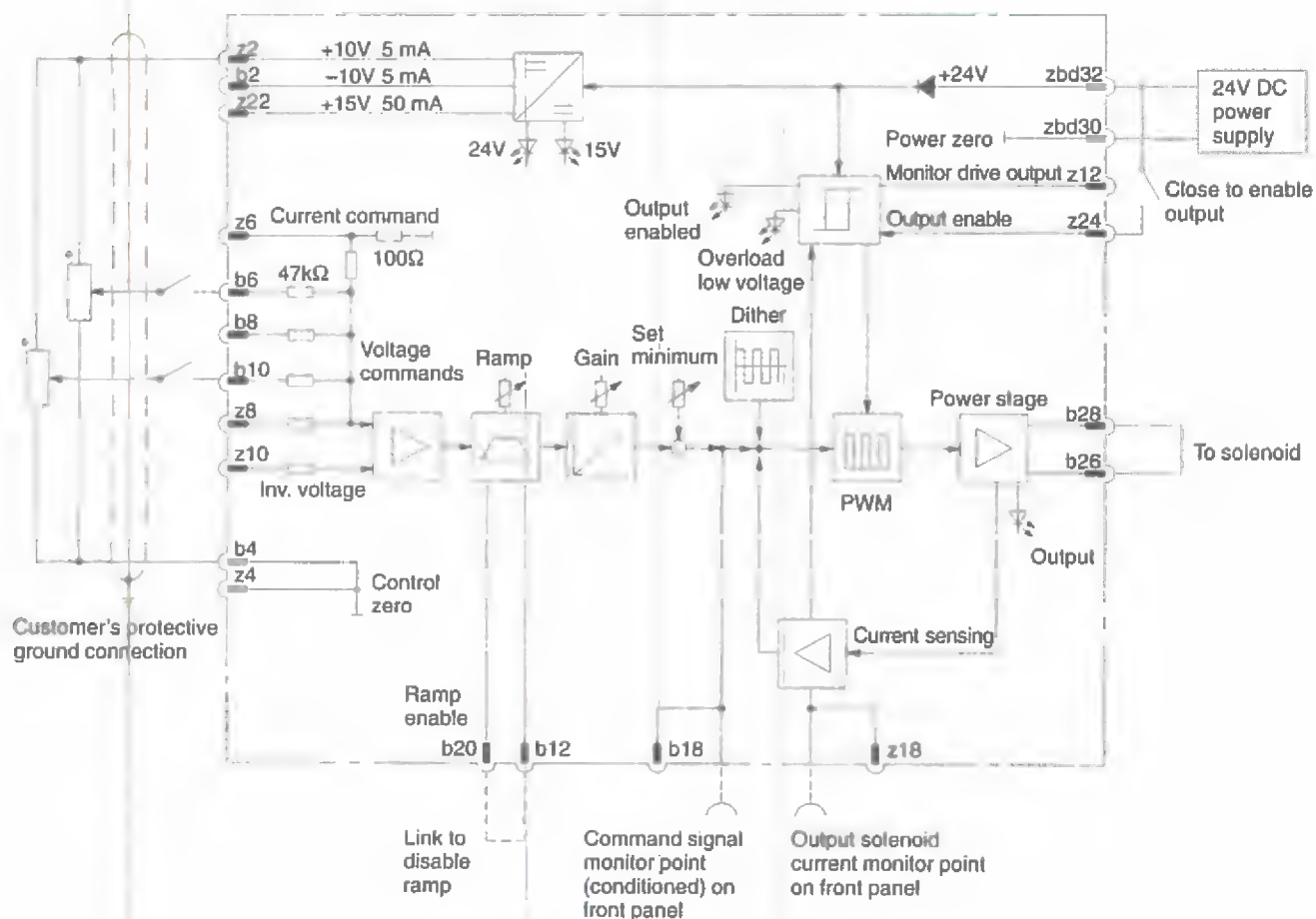
## Operating Data

Power requirements	24V DC nominal x 40W Maximum voltage range: 20 - 34V (including ripple) <4V. pk.-to-pk. ripple Reverse polarity protected Amplifier shuts down below 19V
Output voltages for control z22 z2 and b2	+15V x 50 mA; ripple <50 mV pk-to-pk $\pm 10V (\pm 1\%) \times 5 \text{ mA}$
Command signal inputs Voltage inputs: Direct-voltage pins b8, b6, z8, b10 Inverting-voltage pin z10 Voltage range Input impedance Current input: Current pin z6 Current range Input impedance	0 to 10V 47 k $\Omega$ 0 to 20 mA 100 $\Omega$
Power drive, pulse-width modulated (PWM): Maximum solenoid current	1,8A, short-circuit protected
Dither	Factory-set
Set minimum pressure control: Factory setting Adjustment *	Zero solenoid current 0 to 1,0A solenoid current
Gain control: Factory setting Adjustment	Max. pressure at 10V command signal 0,06 A/V to 0,18 A/V
Ramp time adjustment: Factory setting One adjustment for increasing and decreasing pressure	Minimum (20 ms approx.) 20 ms to 2s with "set minimum" at zero
Overload detection, factory set	Automatic reset when fault removed
Drive enable/disable: z24 Enable (power available to solenoid) Disable (no power to solenoid)	+10V to +30V (>6 k $\Omega$ ) Open circuit or up to 0,8V to z24
Ramps enable/disable: b12, b20 Enable (valve switching rate limited by ramp potentiometer) Disable (fastest valve switching; ramp circuit bypassed)	Open circuit between b20 and b12 Connect b20 to b12
Command signal monitor points: front panel and b18  Output impedance	0 to 10V full scale. Command signal conditioned by "set minimum", gain and ramp function settings. 10 k $\Omega$ ; short-circuit protected
Solenoid current monitor points: front panel and z18 Output impedance	1 V/A solenoid current 10 k $\Omega$ ; short-circuit protected
Drive output status indicator: z12 Drive enabled Drive disabled	>+6V <-6V

Continued on next page

Ambient temperature range	0 to 50°C (32 to 122°F)	<b>Solenoid Connections</b>  
Edge connectors	DIN 41612 F48 male type on the board. Mating connector can be F32 or F48 female type.	
Mass	200g (0.44 lb)	
Installation recommendations leaflet for electronic amplifiers	ML-9046	
Supporting products:		
Power unit	EHA-PSU-704-A/B-10	Note: Connections <i>not</i> polarity sensitive.
Portable test equipment	EHA-TEQ-700-A-20	
Cardholder (F32)	Part no. 02-104807	
Edge connector (F48)	Part no. 508178	

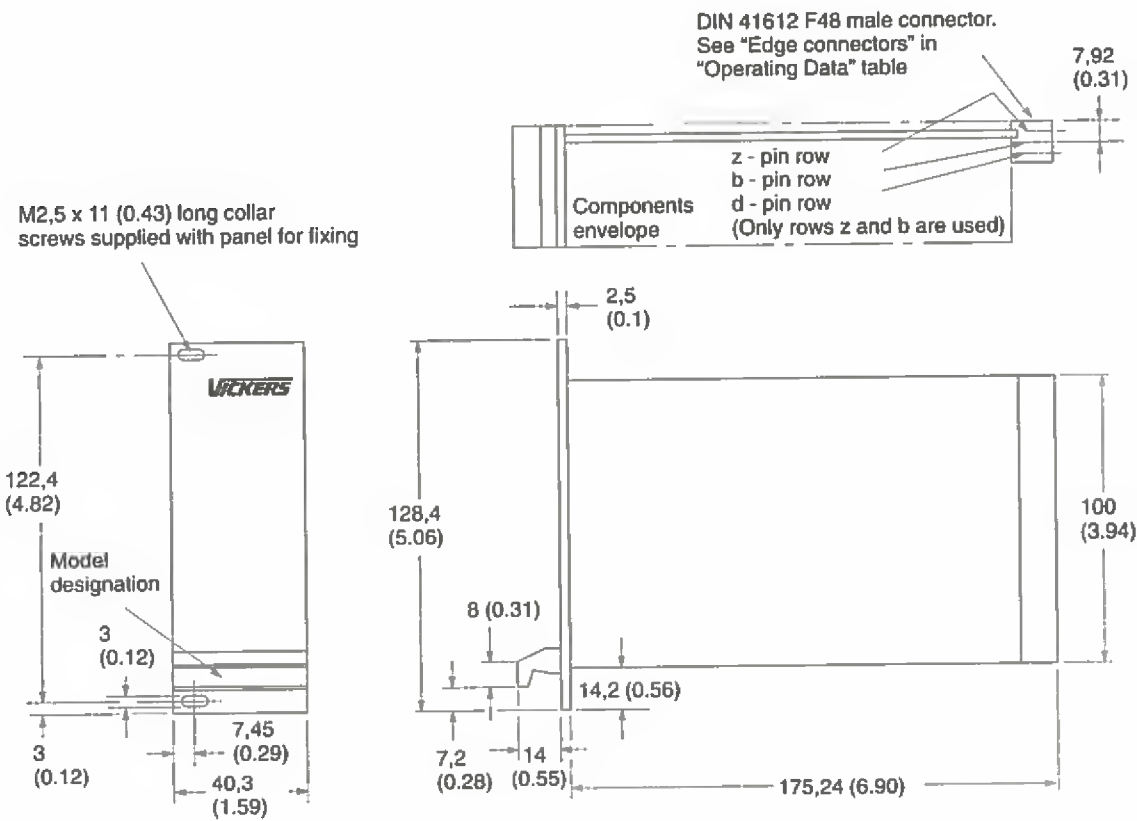
## Circuit and Connections



Note: Connect all shields/screens at card end only.

Installation Dimensions in mm (inches)

Plug-in Unit of 3U Height, to IEC 297



# Power Amplifier

## EEA-PAM-5\*\*-A-32 for Proportional Control Valves

### Contents

The following power amplifier models are covered in this catalog

Power Amplifier	For Proportional Valve
EEA-PAM-513-A-32	KCG-3, 1" series KCG-6/8, 1" series KX(C)G-6/8, 1" series
EEA-PAM-523-A-32	KTG4V-3...H", 6" series KDG4V-3...H", 6" series KDG5V-5/7/8, 1" series
EEA-PAM-525-A-32	KTG4V-5...H", 3" series KDG4V-5...H", 3" series
EEA-PAM-533-A-32	KFTG4V-3, 2" series KFDG4V-3, 2" series
EEA-PAM-535-A-32	KFTG4V-5, 2" series KFDG4V-5, 2" series
EEA-PAM-541-A-32	KHDG5V-5/7/8, 2" series With zero-lapped main spool
EEA-PAM-553-A-32	KSDG4V-3, 1" series
EEA-PAM-561-A-32	KFDG5V-5, 3" series KFDG5V-7, 1" series
EEA-PAM-568-A-32	KFDG5V-8, 1" series
EEA-PAM-571-A-32	CVU-**-EFP1-3"
EEA-PAM-581-A-32	KHDG5V-5/7/8, 2" series

### General Description


The power amplifier has five voltage inputs (one inverting) and a current input for 0-20 mA. Adjustments for set zero point or deadband compensation and for gain allow the amplifier to be easily tuned to the proportional control valve. The ramp function generator can be switched on and off using the "ramp enable" control.

Monitor points on the front panel allow measurement of the conditioned command signal, and either of spool position LVDT signal or (for valves without LVDT) of solenoid current. ("Conditioned command signal" is the input signal modified according to settings of set zero point or deadband compensation, gain and ramp functions.)

### Features

- User-friendly front panel with all the necessary adjustments, LEDs and monitor points
- Electronic overload protection with automatic reset
- Pulse width modulation for high efficiency
- Can be equipped with plug-in modules for special functions
- Switchable ramp function generator for controlling rates of increase and decrease of output
- 24V DC power supply
- Either current or voltage input signals
- Standard input and output signals



This product has been designed and tested to meet specific standards outlined in the European Electromagnetic Compatibility Directive (EMC) 89/336/EEC, amended by 91/263/EEC, 92/31/EEC and 93/68/EEC, article 5. For instructions on installation requirements to achieve effective protection levels, see this leaflet and the Installation Wiring Practices for Vickers Electronic Products leaflet 2468. Wiring practices relevant to this Directive are indicated by  Electromagnetic Compatibility (EMC).

# Front Panel

## Model

523, 525, 533, 535, 561, 568 and 581

### LEDs

- [1] 24V supply voltage, green
- [2] 15V control voltage, green
- [3] Solenoid output enabled, yellow
- [4] Solenoid output overload, red
- [5] LVDT failure, red
- [6] Drive to solenoid, yellow

### Potentiometers

- [7] Deadband compensation, flow from P to B
- [8] Deadband compensation, flow from P to A
- [9] Gain, flow from P to B
- [10] Gain, flow from P to A

### LED

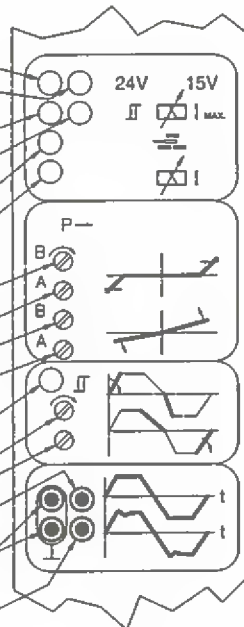
- [11] Ramps enabled, yellow

### Potentiometers

- [12] Acceleration ramp
- [13] Deceleration ramp

### Monitor points ▲

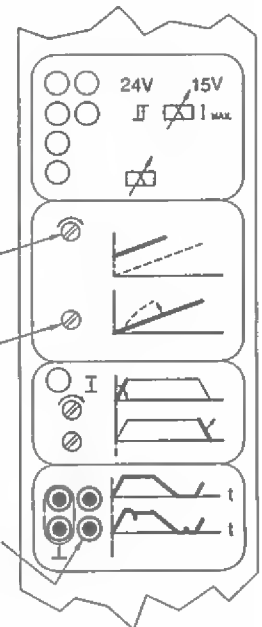
- [14] Conditioned command signal MP1
- [15] Common ground 0V
- [16] Spool position MP2  
(except for 523/525: solenoid current)



513

### Potentiometers

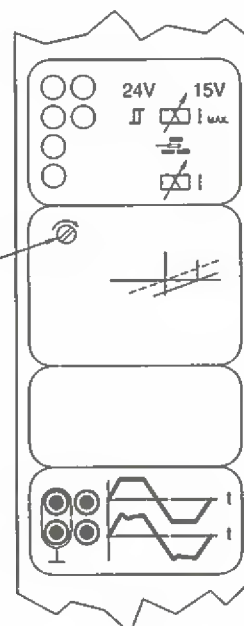
- [17] Zero adjust
- [18] Gain



541, 553

### Potentiometer

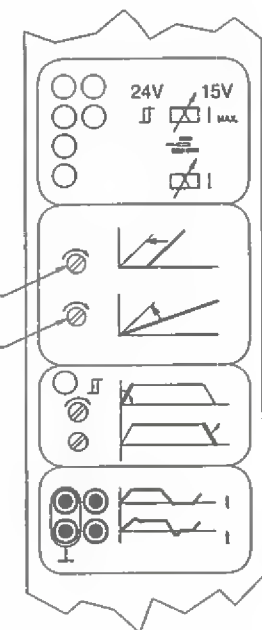
- [20] Adjust valve zero



571

### Potentiometers

- [21] Deadband compensation
- [22] Gain



▲ Ø 2 mm (0.0787" dia.) sockets



### Warning: Electromagnetic Compatibility (EMC)

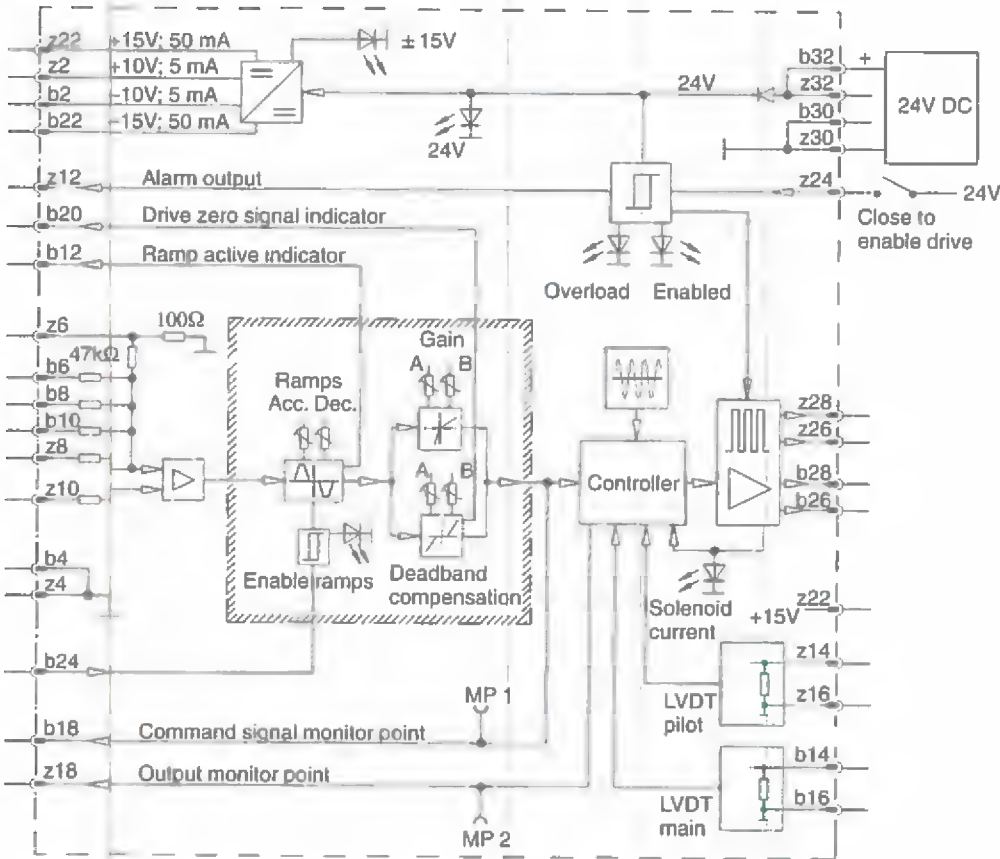
It is necessary to ensure that the unit is wired up in accordance with the connection arrangements shown in this leaflet. For effective protection, the user's electrical cabinet, the valve subplate or manifold and the cable screens should be connected to efficient earth (ground) points. The metal 7-pin connector part no. 934939 should be used for the integral amplifier.

In all cases, both valve and cable should be kept as far away as possible from any source of electromagnetic radiation such as cables carrying heavy current, relays and certain kinds of portable radio transmitters, etc. Difficult environments could mean that extra screening may be necessary to avoid the interference.

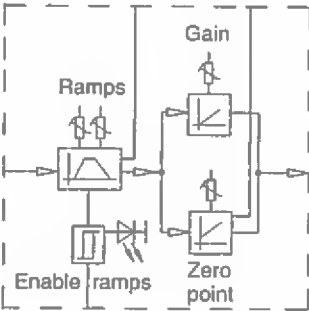
Electrical Block Diagram

EEA-PAM-523/525-A-32  
533/535  
561/568  
571  
581

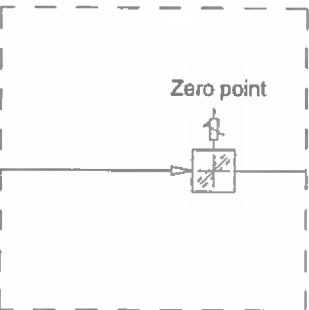
Note: This is a typical diagram and all the features depicted may not be applicable to all amplifiers, (e.g. LVDTs and dither)



EEA-PAM-513-A-32




























EEA-PAM-541-A-32  
553














Command signals and outputs				All models except 553 and 571		
Non-inverting voltage b6/8/10 or z8	Non-inverting current z6	Inverting voltage z10	Secondary pins	Output		
			bz4	P to A	P to B	Valve closed
			bz4			
		+	bz4			
		+	N/A	P to B	P to A	A to B and B to A
+			bz4			
	+		bz4			
		-	bz4			
+		-	N/A			

## Operating Data

<b>Power supply:</b> Nominal $V_{min.} - V_{max.}$ Amplifier shut-down Protection	24V DC x 50W 20 - 40V (incl. pk.-to-pk. ripple $\pm 10\%$ max.) <18V DC Reverse-polarity
<b>Signal sources:</b>  z22 & b22  z2 & b2 <b>Temperature drift</b>	$\pm 15V \times 50 \text{ mA max. (pk.-to-pk. ripple 50 mV)}$ $\pm 10V (\pm 1\%) \times 5 \text{ mA max. (pk.-to-pk. ripple 20 mV)}$ $< 1 \text{ mV/}^\circ\text{C} (< 0,5 \text{ mV/}^\circ\text{F}) \text{ } 0-50^\circ\text{C} (32 - 122^\circ\text{F})$ All outputs short-circuit protected
<b>Command inputs</b> Voltage: Direct-V Inverting-V $U_{min.} - U_{max.}$ Input  z Current  z6: Range, I Input  z	 b8, b6, z8 & b10  z10 $0 \pm 10V$ 47 k $\Omega$  $0 \pm 20 \text{ mA}$ 100 $\Omega$
<b>Power drive</b>	 = PWM short-circuit protected
<b>Max. solenoid current</b>	See table on next page
<b>Current at zero (0V command signal on MP1)</b>	See table on next page
<b>Dither</b>	Factory-set
<b>Deadband compensation</b>	See table on next page
<b>Gain</b>	See table on next page
<b>Ramp-time adjustment:</b> Factory setting   min. - max.   min. - max.	Min. $\approx 50 \text{ ms}$  50 ms - 5s  50 ms - 5s
<b>Overload detection</b>	Automatic reset
<b>Drive:</b> Enabled  z24 Disabled  z24 Input  z	$> 9,8 - < 40V$ Open circuit or $\leq 4,5V$ 22 k $\Omega$
<b>Ramps:</b> Enabled  b24 Disabled  b24 Input  z	$> 9,8 - < 40V$ Open circuit or $\leq 4,5V$ 22 k $\Omega$
<b>Command signal monitor point:</b> Front-panel  MP1 &  b18  Output  z	Monitor signal after deadband compensation (minimum setting), gain and ramps: 0 - 10V ( $10V \triangleq I_{max.}$ ) 10 k $\Omega$ short-circuit protected
<b>Output monitor point</b>  MP2 : Front panel  MP2 &  z18  Output  z	513/523/525 (without LVDT): 1 V/A Other types (with LVDT): $\pm 10V$ at full stroke 10 k $\Omega$ short-circuit protected



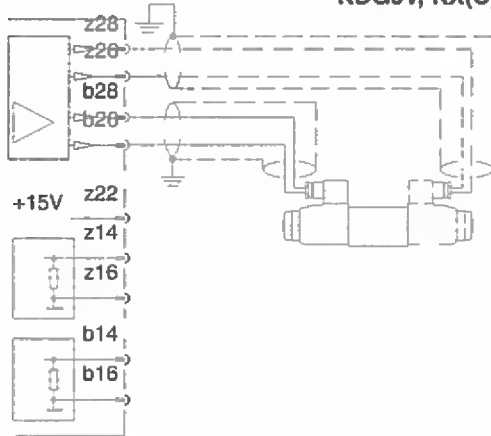
Ramp-active indicator  b12		
		Output > +10V
		Output < -10V
		Output = 0V ( $\pm 2V$ ripple)
Output 	z	10 k $\Omega$
Drive signal zero indicator  b20		
Drive signal at null (within deadband limits)		Output = Supply minus 1,5V; I = 50 mA max.
Drive active		Output = $0 \pm 2V$
Output resistance 	z	50 $\Omega$
Alarm output  z12		
Set alarm		Enable amplifier (on pin z24) when switching power on
Signal		HIGH when alarm is activated: Output = Supply volts minus 2 volts; I = 50 mA max. LOW when solenoid overload has occurred (maintained until reset): Output = 0 to $\pm 2$ volts; Output impedance = 50 $\Omega$
Reset after failure		Disable and re-enable on pin z24
Ambient temperature range		0 - 50°C (32 - 122°F) full specification
Edge connectors DIN 41612		 F48 on board for card holder  F32 or F48
		330g (0.15 lb)
Installation recommendations leaflet, packed with amplifier		ML-9160
Supporting products (see appropriate catalog):		
Power supply	3,5A	EHA-PSU-704-A3-20
	5,0A	EHA-PSU-704-A5-20
	10,0A	EHA-PSU-704-A10-20
Test adaptor Portable test equipment		EBA-TEQ-706-A-10
		EHA-TEQ-700-A-20
		EBA-TEQ-706-A-10
Cardholder	D32	02-104806
	F32	02-104807
	F48	02-104808
Edge connector	F48	732683

Model	513	523 525	533	535	541	553	561 568	571	581
Max. solenoid current	1,6A	1,6A	2,7A	2,7A	3,2A	3,2A	1,8A	2,9A	3,2A
Amplifier input current at 0V command signal (MP1)	0,3A	0,3A	0,3A	0,3A	1,7A	1,7A	1,4A	1,1A	1,7A
Deadband compensation									
Factory setting (% of max. spool stroke)	—	25%	15%	10%	—	—	10%	10%	10%
Adjustment per direction (% of max. spool stroke from centered position)	—	0 - 50%	0 - 50%	0 - 50%	—	—	0 - 50%	0 - 50%	0 - 50%
Gain									
Factory setting	10%/V	10%/V	10%/V	10%/V	10%/V	10%/V	10%/V	10%/V	10%/V
Adjustment per direction	2,5 - 10%/V	2,5 - 10%/V	2,5 - 10%/V	2,5 - 10%/V	—	—	2,5 - 10%/V	2,5 - 10%/V	2,5 - 10%/V
Zero adjustment (% of max. spool stroke)	0 - 50%	—	—	—	+/- 25%	+/- 25%	—	—	—

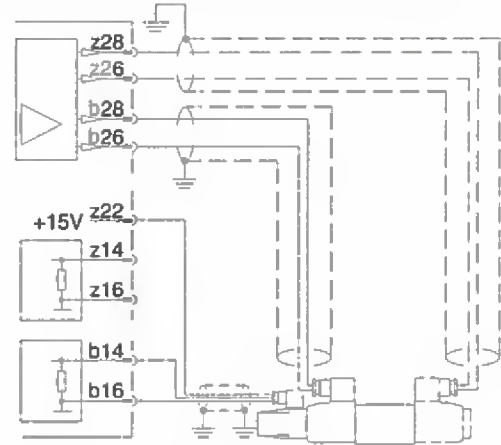
# Wiring Connections

## Amplifier Models (Typical Valve Type)

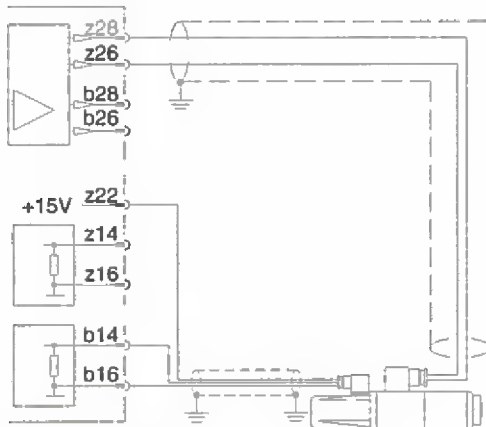
Amplifier Models: 513, 523, 525 (KD/TG4V 3/5, KCG 3/6/8  
KDG5V, KX(C)G 6/8



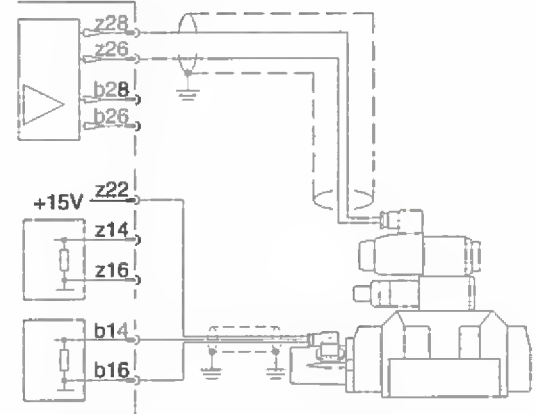
Amplifier Models: 533, 535 (KFD/TG4V 3/5)



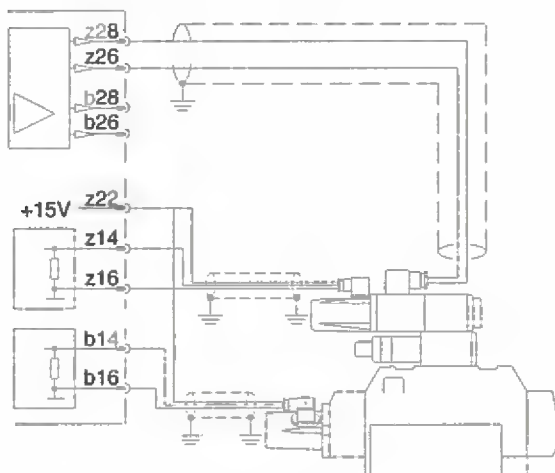
Amplifier Model: 553 (KSDG4V 3)



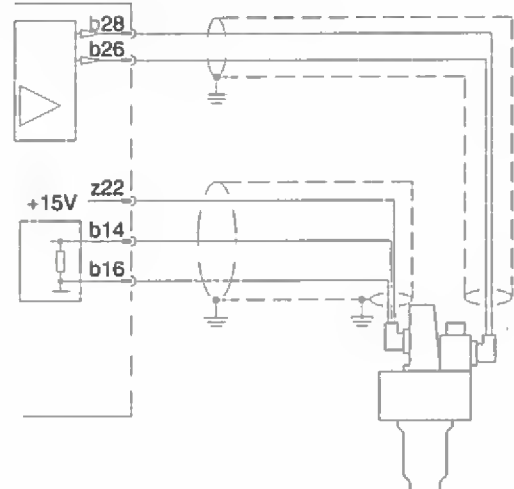
Amplifier Models: 561, 568 (KFDG5V)



Amplifier Models: 541, 581 (KHDG5V)



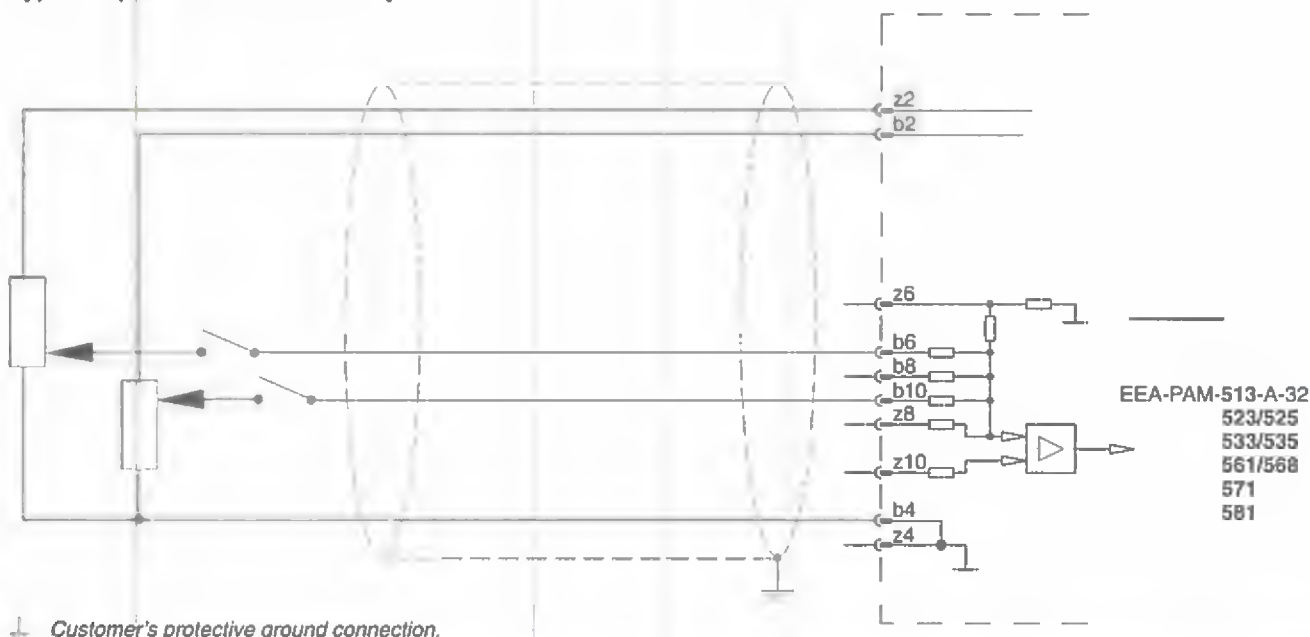
Amplifier Model: 571 (CVU \*\* EFP1)



⏏ Customer's protective ground connection.

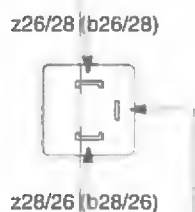
Note: If valves are fitted with the "B" type LVDT, the screen will be grounded at the valve end by the shell of the connector.

## Typical Input Connection Circuitry



## Valve Solenoid Connections

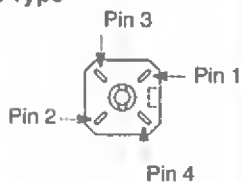
Note: Connection not polarity sensitive.



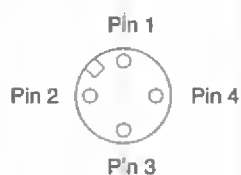
Protective ground: Connection not required if power supply conforms to VDE 0551/EN 60742/IEC 742

## LVDT Connections

### M & E Type



### B Type (EMC)



	LVDT plug pin	Amplifier pin
Pilot stage	1	z14
	2	z22
	3	z16
	4	Not connected
Main stage + CVU-EFP1	1	b14
	2	z22
	3	b16
	4	Not connected



## Electromagnetic Compatibility (EMC)

### Notes for Wiring

Screened cables should be used for the command signals, the solenoid connections and the LVDT connections.

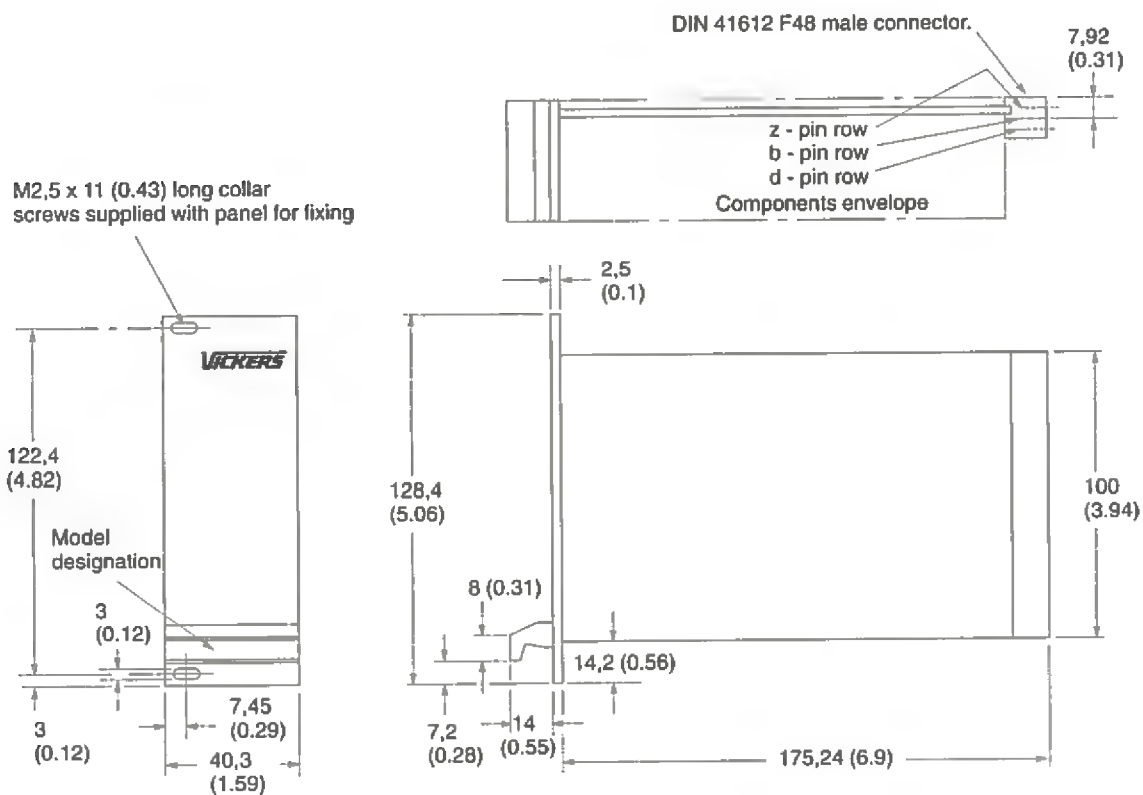
Particular attention should be paid to the grounding of the screens as shown in the diagrams.

The screen on the LVDT cable needs to be grounded at both ends. An alternative method to prevent creating ground loops is to use double screened cable with each screen grounded at opposite ends.

The amplifiers should be mounted in a metal enclosure which is connected to an efficient ground point.

# Installation Dimensions in mm (inches)

Plug-in Unit of 3U Height (IEC 297)



## Power Amplifiers for CVU\*\*-EFP1 Electrohydraulic Proportional Throttle Valves

EEA-PAM-571-A-14 Design

### General Description

This basic amplifier is designed for driving Vickers type CVU\*\*-EFP1 proportional throttle valves in applications requiring only one (adjustable) ramp setting for both acceleration and deceleration.

Analog command input signals can be non-inverting current, or non-inverting, inverting or differential voltages. The amplifier requires a power supply of 24V DC and is enabled by a 24V logic signal. The ramp is normally enabled

but can be selectively disabled by suitable wiring to an external switch.

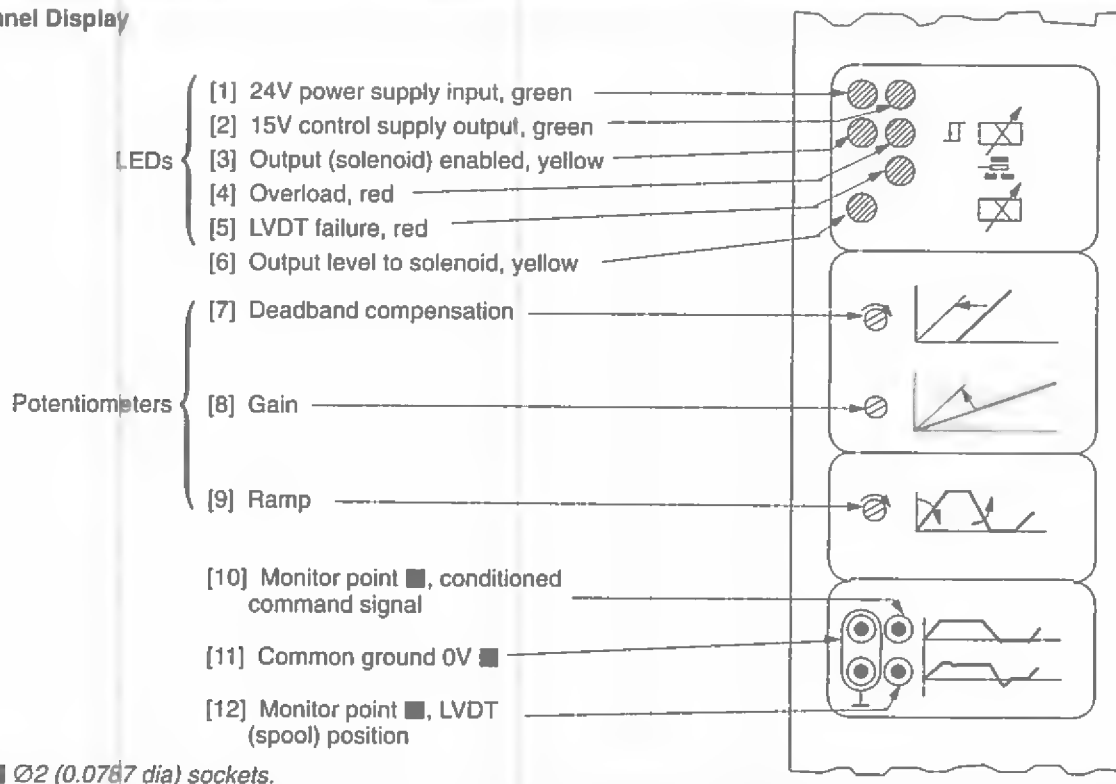
The amplifier front panel contains LEDs showing the status of power, control supply and outputs. Potentiometers for adjusting ramp, deadband compensation and gain are also mounted on the front panel.

### Features

- Basic valve amplifier.
- Voltage and current command signals.

- 1 ramp for acceleration and deceleration.
- 24V DC power supply.
- Pulse-width-modulated coil drives.
- Wider supply voltage range plus high tolerance to ripple.
- Low supply voltage protection.
- Additional monitor points on edge connector.
- Gain positioned in circuitry to give:
  - Ramp setting unaffected by gain adjustment
  - Constant trigger voltage for deadband compensation.

### Panel Display



■ Ø2 (0.0767 dia) sockets.



#### Warning: Electromagnetic Compatibility (EMC)

This product does not conform to the European Community directives for electromagnetic compatibility (EMC). It is only suitable for use within the European Economic Area in a sealed electromagnetic environment or as a spare for an existing machine. (Ref. UK Electromagnetic Compatibility Regulations 14 & 18, 1995.)

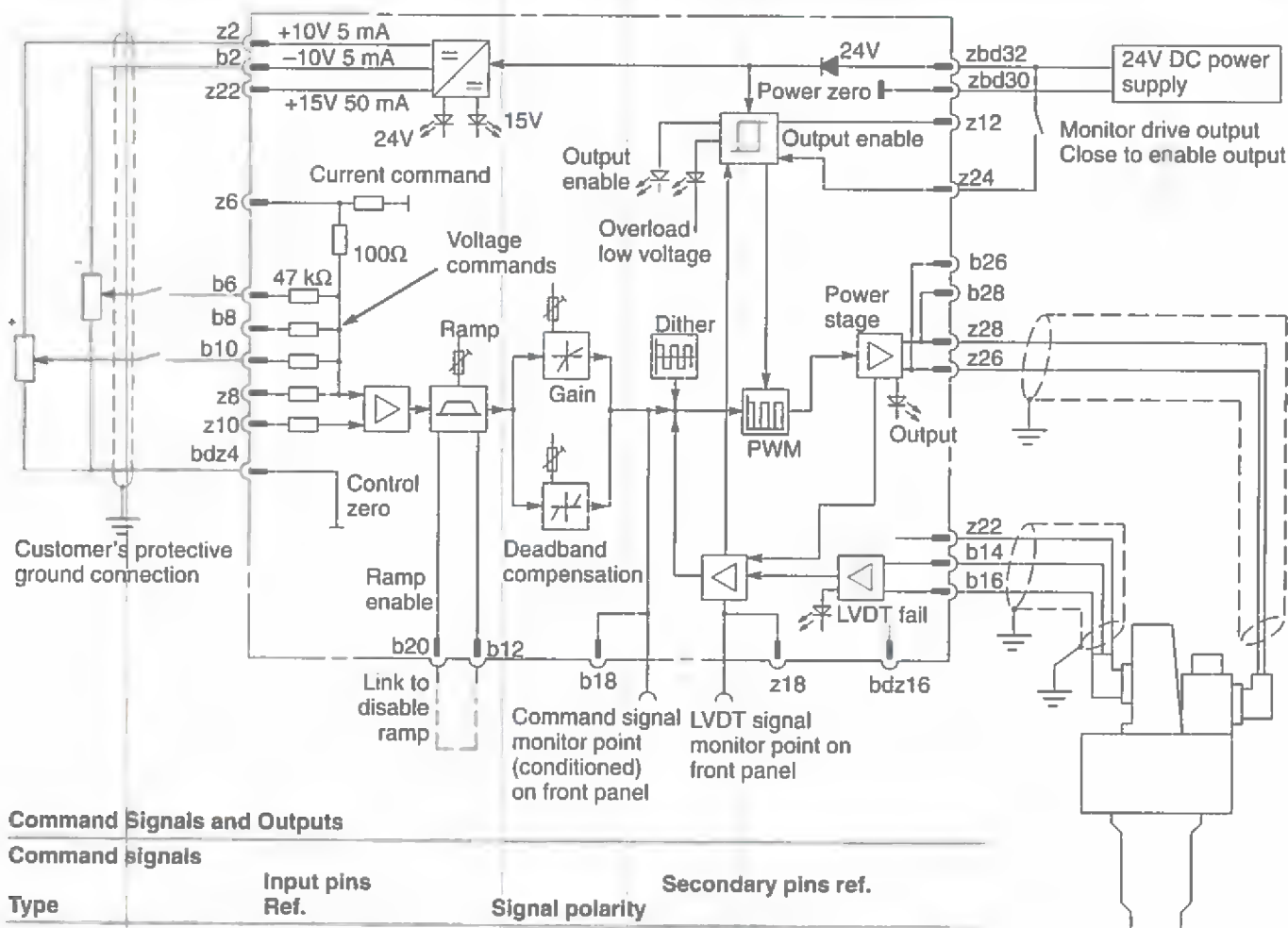
5103.00/EN/0897/A

## Operating Data

Power (input) supply		20 to 34V DC x 40W max. 24V DC nominal <4V pk-to-pk ripple amplifier shuts down below 19V
Control (output) supplies	z22 z2 b2	+15V x 50 mA max. in addition to LVDT demand +10V x 5 mA max. -10V x 5 mA max.
Command signal inputs:		
Direct voltage pins	b8, b6, z8, b10	
Inverting voltage pin	z10	
Voltage range		0 to 10V
Input impedance (voltage)		47 k $\Omega$
Current pin	z6	
Current range		0 to 20 mA
Input impedance (current)		100 $\Omega$
Standing solenoid current at zero command signal		1.1A
Deadband compensation:		
Factory setting		10% of max. stroke▲
Adjustment		0 to 50% of max. stroke▲
Gain control:		
Factory setting		Max. spool stroke at 10V command signal▲
Adjustment per direction from centered position		1.9 to 20% of max. spool stroke per V▲
Ramp time adjustment, linear:		
Factory setting		Max. time
Adjustment		50 ms to 2s, under pre-set deadband compensation and gain conditions
Dither		Factory-set
Feedback from LVDT	b14	12 to 20 mA (100 $\Omega$ )
Overload protection, factory-set		Automatic reset when fault removed
Output enabled (power available to solenoid)	z24	Apply 10 to 30V (6,8 k $\Omega$ )
Output disabled (no power output to solenoid)	z24	Apply $\leq 0,8V$ or open circuit
Ramp enabled (machine actuator acceleration and deceleration limited by ramp potentiometer)	b12/b20	Open circuit between b20 and b12
Ramp disabled (fastest acceleration and deceleration of machine actuator; ramp circuit bypassed)	b12/b20	Link b20 to b12
Command signal monitor point		5V full scale. Command signal conditioned by deadband compensation, gain and ramp functions
Spool position monitor point	Front panel and z18	5V full scale
Monitor point impedance	Front panel and b18	10 k $\Omega$
Monitor point protection		Short-circuit protected
Output point to alarm indicator	z12	>+6V when enabled <-6V when disabled
Ambient temperature range		0 to 50°C (32 to 122°F)
Mass		0,22 kg (0.48 lb)

▲ From spool-closed position.

## Circuit and Connections



### Command Signals and Outputs

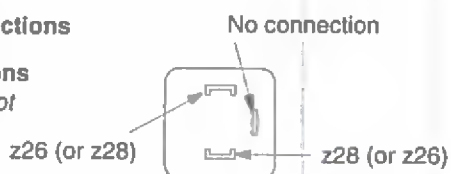
## Command signals

Type	Input pins Ref.	Signal polarity	Secondary pins ref.
Non-inverting voltages	b6/8/10 or z8	+	bdz4
Non-inverting current	z6	+	bdz4
Inverting voltage	z10	-	Link one of b6/8/10 or z8 to bdz4
Differential voltage	z10	-	One of b6/8/10 or z8
	One of b6/8/10 or z8	+	z10

### Valve Wiring Connections

### Solenoid Connections

**Note: Connections *not* polarity sensitive**



## LVDT Connections



LVDT plug pin	Amplifier pin
1	b14
2	z22
3	bdz16
4	—

**Amplifier Cardholder, part number 02-104807**

Vickers amplifiers (plug-in units of 3U height to IEC 297) clip into this type of cardholder, which prevents them from accidentally working loose. Cardholders have a female edge connector to DIN 41612, F32 for the amplifier connection

and screw terminals for wiring connections

**Female Edge Connector for 19" Rack Mounting, part number 508178**

This female edge connector, DIN 41612 type F48, has terminals to which the wires can be soldered. The connectors can be

user-fitted into 19" rack housing designed to accept a number of amplifiers.

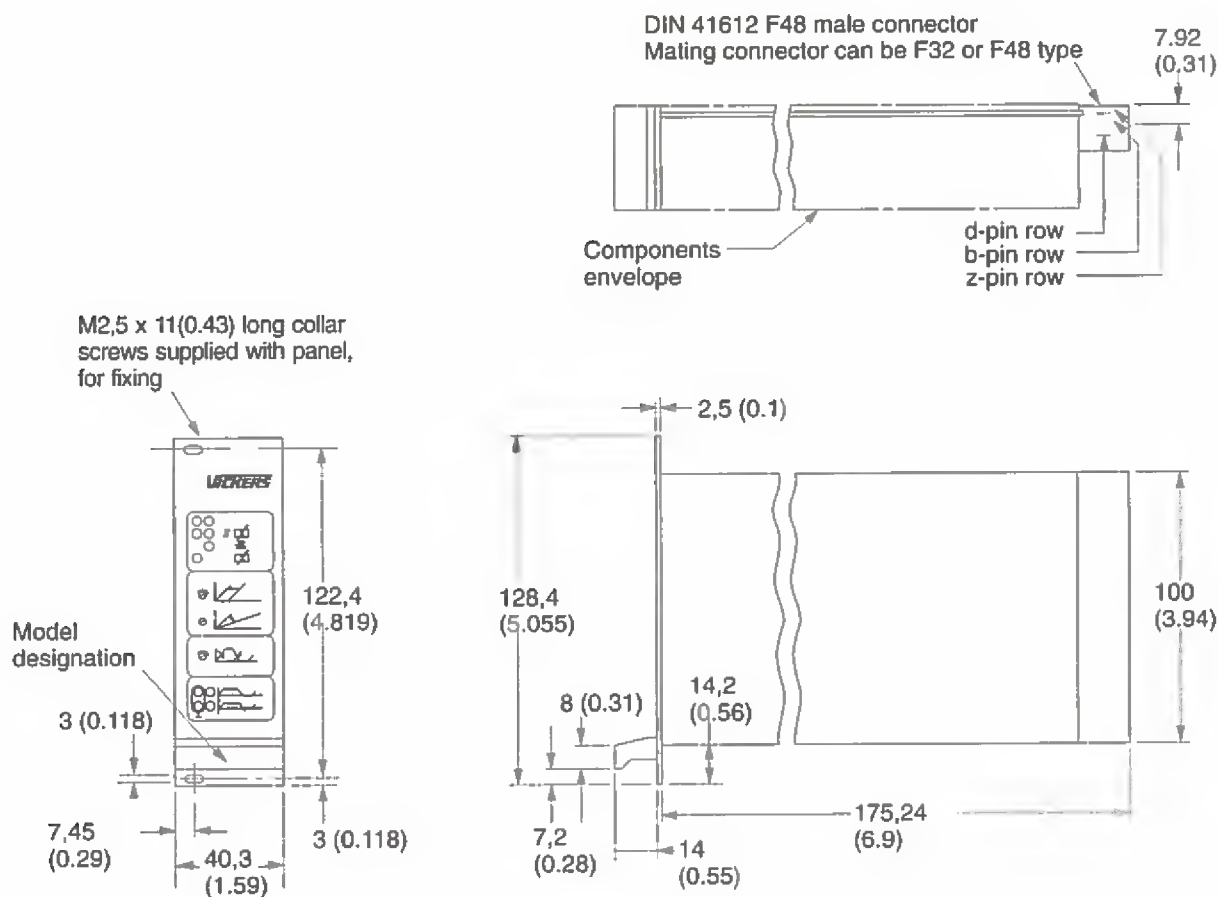
**Supporting products:**

Power supply unit options	EHH PSU 704 * 20
Portable test equipment	EHA TEQ 700 A 20



# Installation Dimensions in mm (inches)

Plug-in Unit of 3U Height, to IEC 297



## Power Amplifiers

### Models with Command Logic Module and 2 Ramps EEA-PAM-5\*\*-B-32 Series

#### General Description

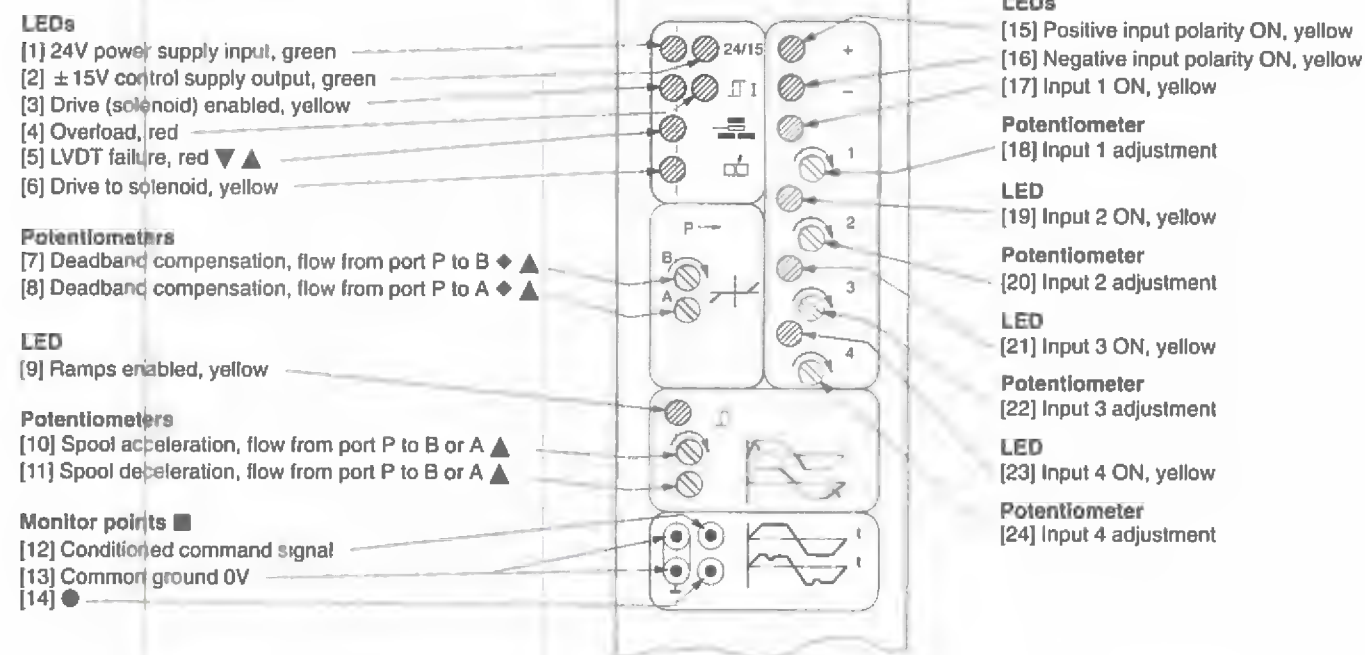
The EEA-PAM-5\*\*-B-32 Eurocards are power amplifiers with a four-input (demand signal) module and ramp function generator with quadrant detection for separate adjustment of acceleration and deceleration.

The type of EEA-PAM-5\*\*-B-32 amplifier used depends on the type of proportional valve, see "Model Codes" on next page.

#### Features and Benefits

- Includes all features of "A" amplifiers
- 2 ramp times set by front-panel potentiometers; can be varied by external voltage signals
- 4 adjustable command pre-sets selectable by 24V logic signal
- Polarity of 10V reference voltage selectable by 24V logic signal

#### Front Panel



▼ LED and symbol not on EEA-PAM-513/523/525 amplifiers.

▲ Main-stage spool in the case of K\*DG5V valves.

◆ In the case of EEA-PAM-523/525 amplifiers, one of these relationships may not apply if two single solenoid valves are connected.

● Of solenoid current in the case of EEA-PAM-513/523/525 models, of spool position for others.

■ Ø2,0 mm (0.0787" dia.) sockets.



This product has been designed and tested to meet specific standards outlined in the European Electromagnetic Compatibility Directive (EMC) 89/336/EEC, amended by 91/263/EEC, 92/31/EEC and 93/68/EEC, article 5. For instructions on installation requirements to achieve effective protection levels, see this leaflet and the Installation Wiring Practices for Vickers Electronic Products leaflet 2468. Wiring practices relevant to this Directive are indicated by ▲ Electromagnetic Compatibility (EMC).

GB-2472

## Model Codes

Amplifier model	For valves
EEA-PAM-513-B-32	KCG-3; KCG-6/8
EEA-PAM-523-B-32	KX(C)G-6/8
EEA-PAM-525-B-32	K*G4V-3; KDG5V-5/7/8
EEA-PAM-533-B-32	K*G4V-5
EEA-PAM-535-B-32	KF*G4V-3
EEA-PAM-561-B-32	KF*G4V-5
EEA-PAM-568-B-32	KFDG5V-5/7
EEA-PAM-571-B-32	KFDG5V-8
EEA-PAM-581-B-32	CVU-**-EFP1
	KHDG5V-5/7/8

With type "H"  
coils only

## Operating Data

Power requirements		See appropriate base amplifier, e.g. for EEA-PAM-535-B-32 see EEA-PAM-535-A-32
Control (output) supplies	z22	+15V for LVDTs only
Output voltages for control:		
At pin z2		+10V ( $\pm 1\%$ ) x 5 mA
At pin b2		-10V ( $\pm 1\%$ ) x 5 mA
At pins z2 and b2		Ripple <20 mV pk.-to-pk. Temperature drift <1 mV/°C (<0,5 mV/°F) thru' 0-50°C (32-122°F) range All outputs short-circuit protected
Command signal inputs:		
Direct-voltage pins	b8, b6, z8, b10	
Inverting-voltage pin	z10	
Voltage range		$\pm 10V$
Input impedance (voltage)		47 k $\Omega$
Current pin	z6	
Current range		$\pm 20$ mA
Input impedance (current)		100 $\Omega$
Command voltage source	d20	$\pm 10V$ x 10 mA
Command voltage polarity selection:		
For flow from (main) port P to A▲		Pin d2 at 0 to +5V
For flow from (main) port P to B▲		Pin d2 at +10 to +40V
Input impedance		47 k $\Omega$
<b>Warning:</b> Loss of signal at pin d2 causes polarity reversal and possible erratic motion.		
▲ In the case of EEA-PAM-523/525 amplifiers, one of these relationships may not apply if two single-solenoid valves are connected.		
Logic inputs:		
Switch-on voltage		+10 to +40V
Switch-off voltage		<+5V
Input current	d10, d12, d14 or d18	$\leq 10$ mA
Command voltage inputs:	d22, d24, d26 and d28	
Voltage and source		+10V gives valve flow from port P to B, or -10V gives flow from P to A◆
Input impedance		Four 50 k $\Omega$ pots
External command potentiometer		5 k $\Omega$ ; 0,25W minimum Part no. 714127; see catalog 2460
		◆ Not applicable when using EEA-PAM-523/525 amplifiers to drive two single-solenoid valves.

Continued on next page

Voltage-controlled ramp generator:		
Acceleration pin	d6	$\pm 10V$
Deceleration pin	d8	$\pm 10V$
		Note: At any ramp pot. setting, positive voltages increase ramp times and negative voltages decrease them. With pot. set at zero, 0 to +10V equates to a ramp time range of 50ms to 5s. With pot. set at max., 0 to -10V equates to a ramp time of 5s to 50 ms.
Input impedance	d6 or d8	10 k $\Omega$
Drive enabled (power available to solenoid)	z24	Apply >9,8V to <40V (22k $\Omega$ )
Drive disabled (no power to solenoid)	z24	Apply open circuit or up to 4,5V
Alarm output:	z12	Enable amplifier (on pin z24) when switching power on HIGH when alarm is activated Output = Supply minus 2V I = 50 mA max. LOW when solenoid overload has occurred. (Maintained until reset.) Output = 0 to $\pm 2$ volts Output resistance = 50 ohms Disable and re-enable on pin z24
Set alarm		
Signal		
Reset after failure		
Ramps enabled (valve switching rate limited by ramp potentiometers)	b24	Apply >9,8V to <40V (22 k $\Omega$ )
Ramps disabled (fastest valve switching; ramp circuit bypassed)	b24	Apply open circuit or up to 4,5V
Ramp active indicator:	b12	Output >10V Output <-10V Output 0V ( $\pm 2V$ ripple) 10 k $\Omega$
Drive ramping up		
Drive ramping down		
Drive not ramping		
Output resistance		
Drive signal zero indicator:	b20	Output = Supply minus 1,5V I = 50 mA max. Output = 0 $\pm 2V$ 50 $\Omega$
Drive signal at null (within deadband limits)		
Drive active		
Output resistance		
Ambient temperature range		0 to 50°C (32 to 122°F)
Storage temperature range		-25 to +85°C (-12 to +185°F)
Edge connectors		DIN 41612 F48 male type on board. Mating connector must be an F48 female type
Installation dimensions and panel display		Dimensions are the same as for the corresponding base amplifier but the panel display is different; see first page
Mass		0,40 kg (0.88 lb) approx.
Other characteristics		See catalog 2464 for the relevant base amplifier EEA-PAM-5**-A-32.
Installation and start-up guidelines (supplied with product)		9166
Installation wiring requirements for Vickers electronic products		2468
Application notes (available on request)		9060
Supporting products:		See catalogs:
Power unit options		2419
Electronic accessories		2460
Portable test equipment		2462 and 2315

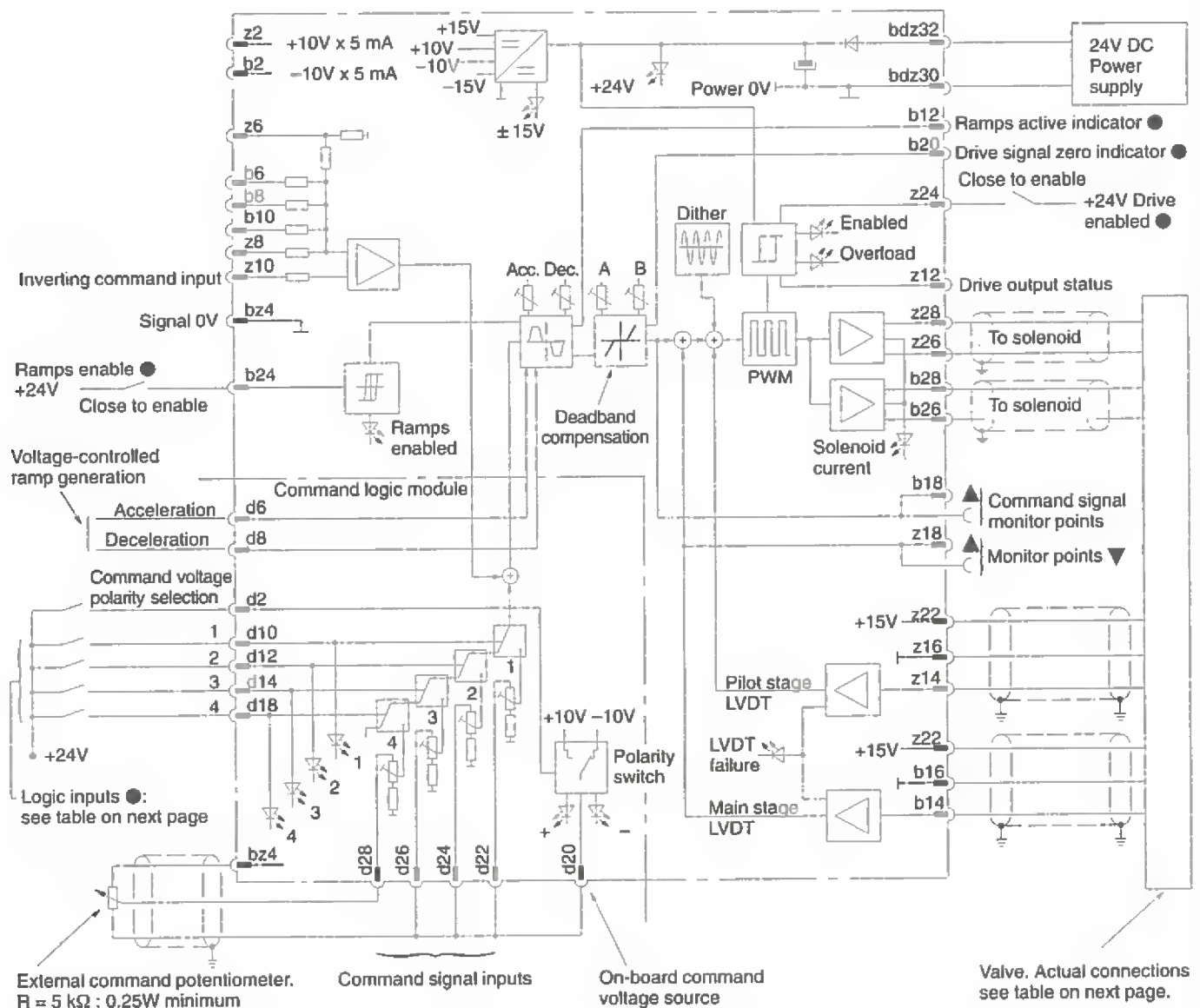
## Circuit and Connections

### EEA-PAM-5\*\*-B-32

Shown with command logic module.  
Individual ramp adjustments of spool acceleration and deceleration, independent of direction of movement, are on the base amplifier. Additionally, acceleration and deceleration can be controlled by variable voltage inputs to

pins d6 and d8 respectively. The circuit here includes the essential characteristics of all amplifiers listed in the "Model Codes" section, two pages back; actual amplifiers omit certain sub-circuits to those connection pins not needed for the valves concerned.

*Read circuit in conjunction with that for relevant base amplifier EEA-PAM-5\*\*-A*



Customer's protective ground connection.

▼ Solenoid current for 523/525-B models; LVDT position for all others.

▲ On front panel.

● See under this heading in "Operating Data" table, on previous two pages.

### Logic Selection Inputs

Logic input pin	Command pot.	Secondary pin	Voltage to pin d2	Valve flow
d10	1	bdz30	0 +24V	P-A P-B } ■
d12	2	bdz30	0 +24V	P-A P-B } ■
d14	3	bdz30	0 +24V	P-A P-B } ■
d18	4	bdz30	0 +24V	P-A P-B } ■

■ In the case of EEA-PAM-523/525-B models, one of these relationships may not apply if two single-solenoid valves are connected.

## Solenoid and LVDT Connections for Proportional Valves

Amplifier type		Solenoid with LVDT and/or for flow P to B	Solenoid without LVDT, or on pilot valve	Pilot-stage LVDT, (black plug):				Main-stage LVDT, (gray plug):			
				Pin 1	Pin 2	Pin 3	Pin 4	Pin 1	Pin 2	Pin 3	Pin 4
EEA-PAM-513-B-32	b26/b28	—	—	—	—	—	Not connected	—	—	—	Not connected
EEA-PAM-523-B-32	b26/b28	z26/z28	—	—	—	—	Not connected	—	—	—	Not connected
EEA-PAM-525-B-32	b26/b28	z26/z28	—	—	—	—	Not connected	—	—	—	Not connected
EEA-PAM-533-B-32	b26/b28	z26/z28	—	—	—	—	Not connected	b14	z22	b16	Not connected
EEA-PAM-535-B-32	b26/b28	z26/z28	—	—	—	—	Not connected	b14	z22	b16	Not connected
EEA-PAM-561-B-32	—	z26/z28	—	—	—	—	Not connected	b14	z22	b16	Not connected
EEA-PAM-568-B-32	—	z26/z28	—	—	—	—	Not connected	b14	z22	b16	Not connected
EEA-PAM-571-B-32	—	z26/z28	—	—	—	—	Not connected	b14	z22	b16	Not connected
EEA-PAM-581-B-32	—	z26/z28	—	z14	z22	z16	Not connected	b14	z22	b16	Not connected



#### Warning: Electromagnetic Compatibility (EMC)

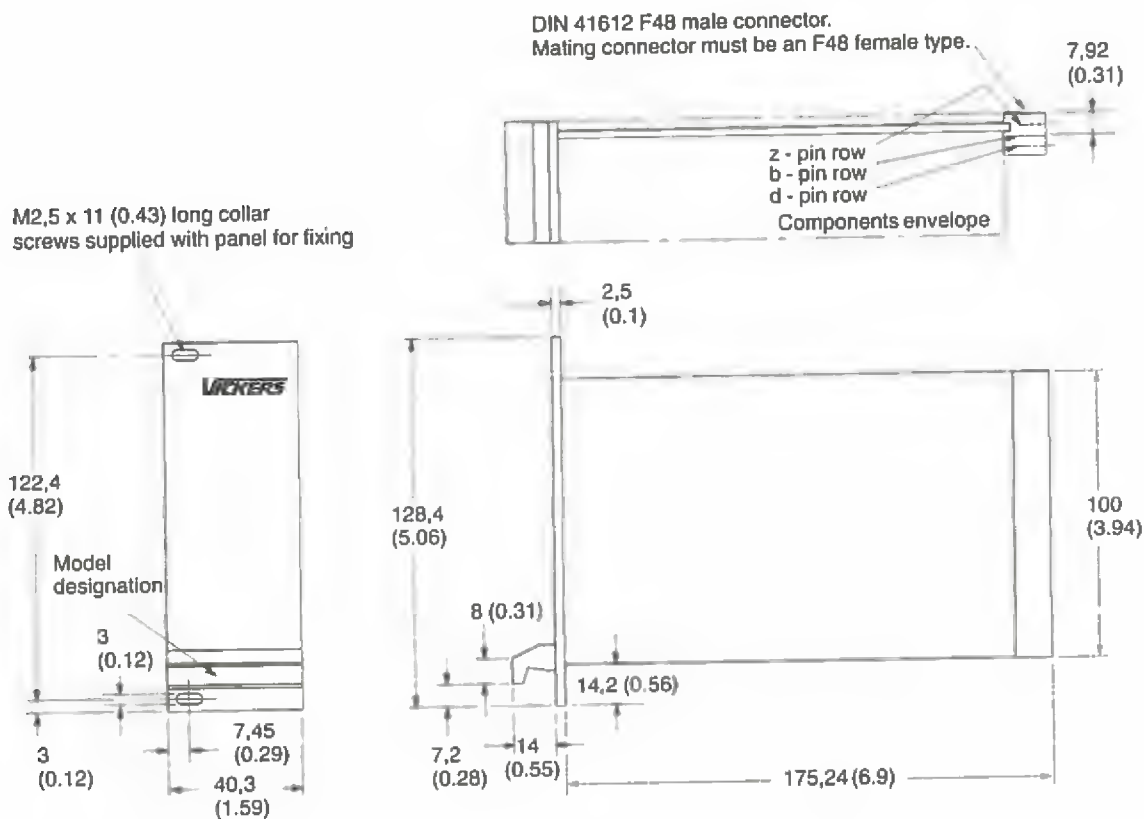
It is necessary to ensure that the valve is wired up in accordance with the connection arrangements shown in this leaflet. For effective protection, the user's electrical cabinet, the valve subplate or manifold and the cable screens should be connected to efficient earth (ground) points. The metal 7-pin connector part no. 934939 should be used for the integral amplifier.

In all cases, both valve and cable should be kept as far away as possible from any source of electromagnetic radiation such as cables carrying heavy current, relays and certain kinds of portable radio transmitters, etc. Difficult environments could mean that extra screening may be necessary to avoid the interference.

# Installation Dimensions in mm (inches)

Plug-in Unit of 3U Height, to IEC 297

3rd angle  
projection





Alarm output: Set alarm Signal	z12	Enable amplifier (on pin z24) when switching power on HIGH when alarm is activated Output = Supply minus 2V I = 50 mA max. LOW when solenoid overload has occurred. (Maintained until reset.) Output = 0 to $\pm 2$ volts Output resistance = 50 ohms Disable and re-enable on pin z24
Reset after failure		
Ramps enabled (valve switching rate limited by ramp potentiometers)	b24	Apply >9,8V to <40V (22 k $\Omega$ )
Ramps disabled (fastest valve switching; ramp circuit bypassed)	b24	Apply open circuit or up to 4,5V
Ramp active indicator Drive ramping up Drive ramping down Drive not ramping Output resistance	b12	Output >10V Output <-10V Output 0V ( $\pm 2$ V ripple) 10 k $\Omega$
Drive signal zero indicator Drive signal at null (within deadband limits)	b20	Output = Supply minus 1,5V I = 50 mA max. Output = 0 $\pm 2$ V 50 $\Omega$
Drive active Output resistance		
Ambient temperature range		0 to 50°C (32 to 122°F)
Storage temperature range		-25 to +85°C (-12 to +185°F)
Edge connectors		DIN 41612 F48 male type on board. Mating connector must be an F48 female type
Installation dimensions and panel display		Dimensions are the same as for the corresponding base amplifier but the panel display is different; see first page
Mass		0,40 kg (0.88 lb) approx.
Other characteristics		See catalog 2464 for the relevant base amplifier EEA-PAM-5**-A-32
Installation and start-up guidelines (supplied with product)		9166
Installation wiring requirements for Vickers electronics products		2468
Application notes (available on request)		9061
Supporting products: Power unit options Electronic accessories Portable test equipment		See catalogs: 2419 2460 2462 and 2315



**Warning: Electromagnetic Compatibility (EMC)**

*It is necessary to ensure that the valve is wired up in accordance with the connection arrangements shown in this leaflet. For effective protection, the user's electrical cabinet, the valve subplate or manifold and the cable screens should be connected to efficient earth (ground) points. The metal 7-pin connector part no. 934939 should be used for the integral amplifier.*

*In all cases, both valve and cable should be kept as far away as possible from any source of electromagnetic radiation such as cables carrying heavy current, relays and certain kinds of portable radio transmitters, etc. Difficult environments could mean that extra screening may be necessary to avoid the interference.*

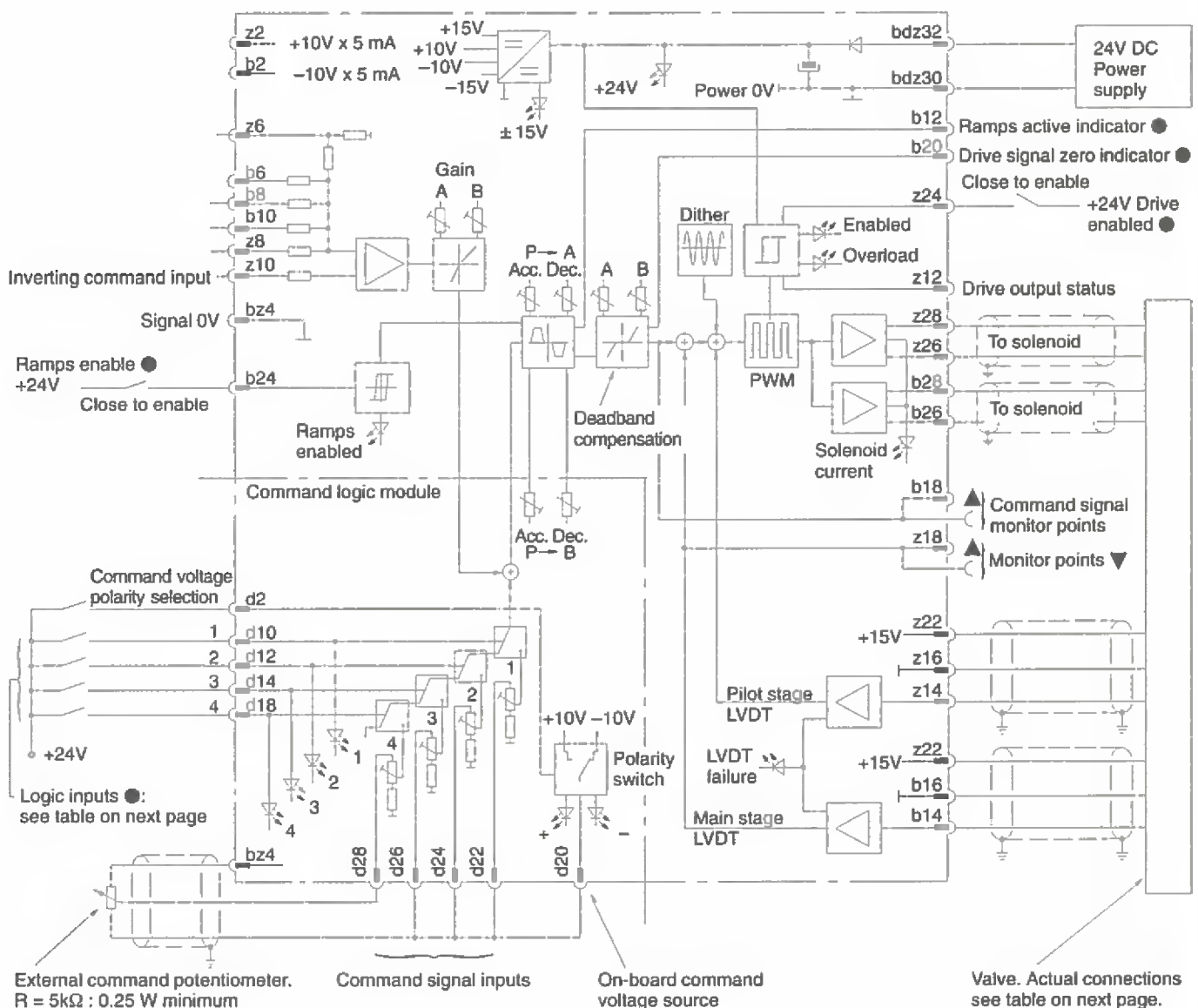
# Circuit and Connections

## EEA-PAM-5\*-C-32

Shown with command logic module.  
Individual ramp adjustments of spool acceleration and deceleration for each direction of movement, are provided.  
The circuit here includes the essential

characteristics of all amplifiers listed in the "Model Codes" section, two pages back; actual amplifiers omit certain sub-circuits to those connection pins not needed for the valves concerned.

Read circuit in conjunction with that for relevant base amplifier EEA-PAM-5\*-A



⬤ Customer's protective ground connection.

▼ Solenoid current for 523/525-C models; LVDT position for all others.

▲ On front panel.

● See under this heading in "Operating Data" table, on previous two pages.

### Logic Selection Inputs

Logic input pin	Command pot.	Secondary pin	Voltage to pin d2	Valve flow
d10	1	bdz30	0 +24V	P-A P-B } ■
d12	2	bdz30	0 +24V	P-A P-B } ■
d14	3	bdz30	0 +24V	P-A P-B } ■
d18	4	bdz30	0 +24V	P-A P-B } ■

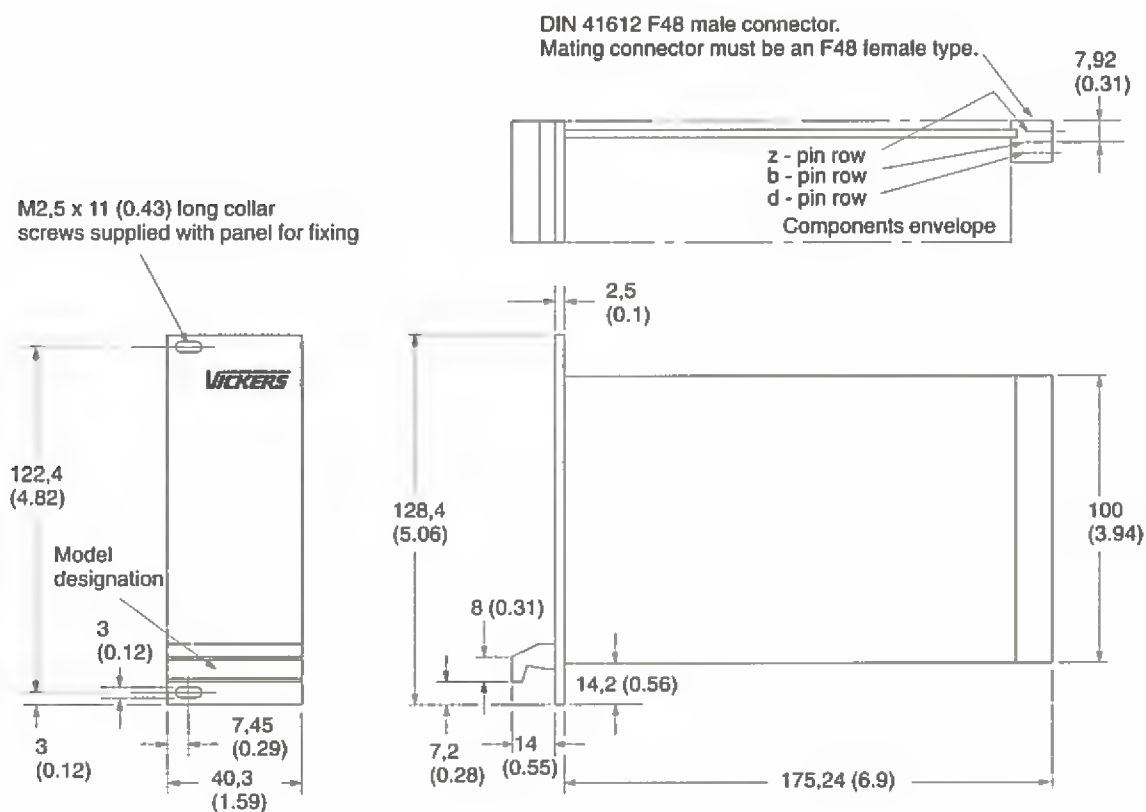
■ In the case of EEA-PAM-523/525-C models, one of these relationships may not apply if two single-solenoid valves are connected.

### Solenoid and LVDT Connections for Proportional Valves

Amplifier type	Solenoid with LVDT and/or for flow P to B	Solenoid without LVDT, or on pilot valve	Pilot-stage LVDT, (black plug):				Main-stage LVDT, (gray plug):			
			Pin 1	Pin 2	Pin 3	Pin 4	Pin 1	Pin 2	Pin 3	Pin 4
EEA-PAM-523-C-32	b26/b28	z26/z28	—	—	—	Not connected	—	—	—	Not connected
EEA-PAM-525-C-32	b26/b28	z26/z28	—	—	—	Not connected	—	—	—	Not connected
EEA-PAM-533-C-32	b26/b28	z26/z28	—	—	—	Not connected	b14	z22	b16	Not connected
EEA-PAM-535-C-32	b26/b28	z26/z28	—	—	—	Not connected	b14	z22	b16	Not connected
EEA-PAM-561-C-32	—	z26/z28	—	—	—	Not connected	b14	z22	b16	Not connected
EEA-PAM-568-C-32	—	z26/z28	—	—	—	Not connected	b14	z22	b16	Not connected

# Installation Dimensions in mm (inches)

Plug-in Unit of 3U Height, to IEC 297



## Power Amplifiers with PID Modules

### EEA-PAM-5\*\*-D-32 Series

#### General Description

The EEA-PAM-5\*\*-D-32 Eurocards are power amplifiers with integrated PID modules. Each of these cards replaces two conventional electronic cards.

#### Features and Benefits

- Includes all features of "A" amplifiers (except gain)
- User configurable PID feed-forward, closed-loop operation
- Command input ramps
- Analog feedback sensor interface
- Automatic switch-over p/Q function
- Built-in test feature
- The design reduces the amount of external wiring, saves space in the rack enclosure and requires only one 24V supply
- The general purpose, integrated module can be configured using DIL switches (D1-D9) and potentiometers for the following applications:
  - Closed-loop pressure control using either proportional pressure valves or servo-performance proportional valves
  - Closed-loop velocity control
  - Closed-loop position control
  - p/Q control with internal or external switch-over from Q to p
- The DIL- switch and potentiometer settings can easily be reconfigured on different cards

#### Front Panel

##### LEDs

- [1] 24V power supply input, green
- [2] 15V control supply output, green
- [3] Drive (solenoid) enabled, yellow
- [4] Overload, red
- [5] LVDT failure, red ●
- [6] Drive level to solenoid, yellow

##### Potentiometers

- [7] Deadband compensation, flow P to B ▲ ◆
- [8] Deadband compensation, flow P to A ▲ ◆

##### LED

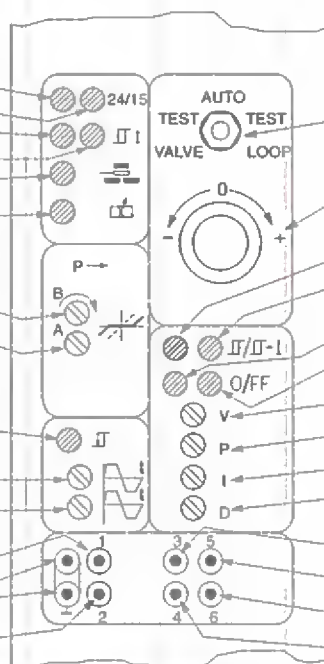
- [9] Ramps enabled, yellow

##### Potentiometers

- [10] Command ramp up
- [11] Command ramp down

##### Monitor points ■

- [12] MP1: Conditioned command signal
- [13] Common ground (0V)
- [14] MP2: LVDT (spool) position ▼



- [15] Mode switch
  - TEST VALVE setting
  - AUTO function setting
  - TEST LOOP setting

- [16] Test potentiometer

##### LEDs

- [17] PID-controller enabled, yellow
- [18] Integrator enabled, yellow
- [19] Feedback = command signal, green
- [20] Sensor failure, red

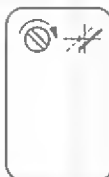
##### Potentiometers

- [21] Feed-forward signal scaling
- [22] P-gain
- [23] I-gain
- [24] D-gain

##### Monitor points ■

- [25] MP3: Command signal
- [26] MP5: PID-controller output
- [27] MP6: Integrator output
- [28] MP4: Feedback signal

▲ Number and function of potentiometers [7], [8], [7.2] vary according to model type as follows: [7.2] Offset  
For models 513/541/553-



- LED and symbol not on EEA-PAM-513/523/525 amplifiers.
- ▼ Solenoid current for EEA-PAM-523/525-D models.
- Ø2,0 mm (0.0787" dia.) sockets.
- ◆ In the case of EEA-PAM-523/525-D models one of these relationships may not apply if two single solenoid valves are connected.



This product has been designed and tested to meet specific standards outlined in the European Electromagnetic Compatibility Directive (EMC) 89/336/EEC, amended by 91/263/EEC, 92/31/EEC and 93/68/EEC, article 5. For instructions on installation requirements to achieve effective protection levels, see this leaflet and the Installation Wiring Practices for Vickers Electronic Products leaflet 2468. Wiring practices relevant to this Directive are indicated by ▲ Electromagnetic Compatibility (EMC).

GB-2474A

## Model Codes


Amplifier model	For valves
EEA-PAM-513-D-32	KCG-3, KCG-6/8
EEA-PAM-523-D-32	KX(C)G-6/8
EEA-PAM-525-D-32	K*G4V-3, KDG5V-5/7/8
EEA-PAM-533-D-32	K*G4V-5
EEA-PAM-535-D-32	KF*G4V-3
EEA-PAM-541-D-32	KF*G4V-5
EEA-PAM-553-D-32	KHDG5V-5/7/8 with zerolapped mainpool
EEA-PAM-561-D-32	KSDG4V-3
EEA-PAM-568-D-32	KFDG5V-5/7
EEA-PAM-571-D-32	KFDG5V-8
EEA-PAM-581-D-32	CVU-**-EFP1
	KHDG5V-5/7/8

## Operating Data

Power (input) supply	bz32	See appropriate base amplifier, e.g. for EEA-PAM-535-D-32 see EEA-PAM-535-A-32
Control (output) supplies	z22	+15V for LVDTs only
Reference voltages	z2	+10V x 5 mA
	b2	-10V x 5 mA
Analog inputs:		
Command inputs		
Direct-voltage inputs	b6, b8, b10, z8	
Inverting-voltage input	z10	
Voltage range		± 10V
Input impedance (voltage)		47 kΩ
Current input	z6	
Current range		± 20 mA
Input impedance (current)		100Ω
Feed-forward input	d8	
Input impedance		6 kΩ
Voltage range		± 10V
Input to ramp generator	d28	
Input impedance		10 kΩ
Voltage range		± 10V
Inputs from sensors		
Voltage input	d2	
Input impedance		1 MΩ
Voltage range		0 to 10V, or ± 10V■
Current input		
Input impedance		100Ω
Current range (See "DIL Switches" five pages on)		4-20 mA or 0-20 mA
Monitoring of sensor failure for sensors with a current output only		

■ The demand signal should have the same voltage range as the sensor feedback, i.e. 0 to 10V, or ± 10V.

Continued on next page

Digital inputs: Drive enable (power available to solenoid) Ramps enable Integrator enable	z24 b24 d14	 <p><b>Warning:</b> In a power-up sequence, the integrator should not be enabled until all hydraulic, electric and control power and signals are applied and stable. Abrupt or unpredictable motion may occur if integrator is enabled during this transition time.</p>
PID-controller enable Enabled Disabled Load current	d12	17 to 40V 0 to 3,5V ≤ 10 mA
Digital outputs: Sensor failure Sensor failure Sensor o.k. Load current (withstands a continuous short-circuit condition) This output may be used only in conjunction with sensors providing a current output (4-20 mA) Feedback = command signal Feedback matches demand Feedback does not match demand Load current (withstands a continuous short-circuit condition) The load at pin d18 and pin d10 has to be connected to ground	d18       d10	Vcc -2V <3V ≤ 100 mA    Vcc -2V <3V ≤ 100 mA
Analog outputs: PID-controller output Error signal Feedback signal Load impedance Voltage range Output from ramp generator Load resistance Voltage range	d4 d22 d24   d26	≥ 10 kΩ; short-circuit proof ± 10V   ≥ 5 kΩ; short-circuit proof ± 10V
Alarm output (drive output status): Set alarm   Signal   Reset after failure	z12	Enable amplifier (on pin z24) >500 ms after switching power on. HIGH when alarm is activated. Output = Supply volts minus 2 volts. I = 50 mA max. LOW when solenoid overload has occurred. (Maintained until reset). Output = 0 to +/-2 volts. Output resistance = 50 ohms. Disable and re-enable on pin z24.
Ramp active indicator: Drive ramping up Drive ramping down Drive not ramping Output resistance	b12	Output >10V Output <-10V Output 0 ± 10V 10 kΩ
Drive signal zero indicator: Drive signal at null (within deadband limits) Drive active Output resistance	b20	Output = Supply minus 1,5V; I = 50 mA max. Output = 0 ± 2V 50Ω

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Potentiometers: Feed-forward P-gain (depends on DIL switch D2): I-gain range D-gain range Sensor signal gain range ■ Sensor signal offset range ■		$V = 20\% \text{ to } 100\%$ $P = 0,1 \text{ to } 50V/V$ $K_i = 0,5 \text{ to } 100 \text{ V/s/V}$ $K_d = 0 \text{ to } 0,05 \text{ V/V/s}$ $90\% \text{ to } 120\%$ $\pm 10\%$
Monitor points: Conditioned command signal LVDT (spool) position ▲ Command signal Feedback signal PID-controller output Integrator output (100%, independent of D3, D4, D5) Voltage range Monitor point impedance	MP1 MP2 MP3 MP4 MP5 MP6	$\pm 10V$ $10 \text{ k}\Omega$
Ambient conditions: Storage temperature range Operating temperature range		$-25 \text{ to } +85^\circ\text{C} (-13 \text{ to } +185^\circ\text{F})$ $0 \text{ to } 50^\circ\text{C} (32 \text{ to } 122^\circ\text{F})$
Mass		0,4 kg (0.88 lb) approx.
Installation and start-up guidelines (supplied with product)		9161
Installation wiring requirements for Vickers electronic products		2468
Application notes (available on request)		9056
Supporting products: Power supply unit options Electronic accessories Portable test equipment		See catalogs: 2419 2460 2462 and 2315

■ Located on PID module.

▲ All amplifiers except EEA-PAM-523/525 models, in which solenoid current is monitored.



**Warning: Electromagnetic Compatibility (EMC)**

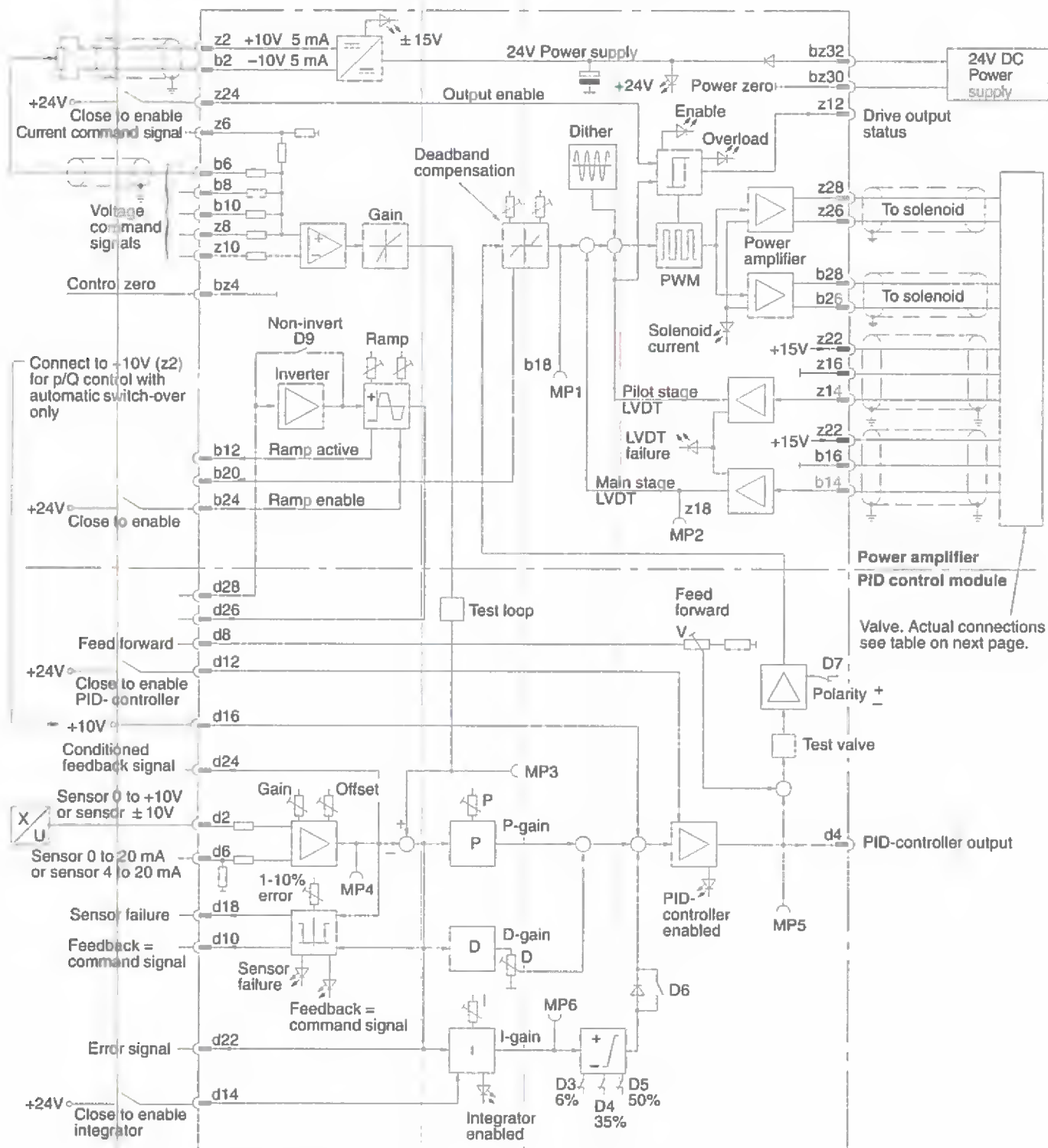
It is necessary to ensure that the valve is wired up in accordance with the connection arrangements shown in this leaflet. For effective protection, the user's electrical cabinet, the valve subplate or manifold and the cable screens should be connected to efficient earth (ground) points. The metal 7-pin connector part no. 934939 should be used for the integral amplifier.

In all cases, both valve and cable should be kept as far away as possible from any source of electromagnetic radiation such as cables carrying heavy current, relays and certain kinds of portable radio transmitters, etc. Difficult environments could mean that extra screening may be necessary to avoid the interference.

# Circuit and Connections

EEA-PAM-5\*\*-D-32

Read circuit in conjunction with that for relevant base amplifier EEA-PAM-5\*\*-A



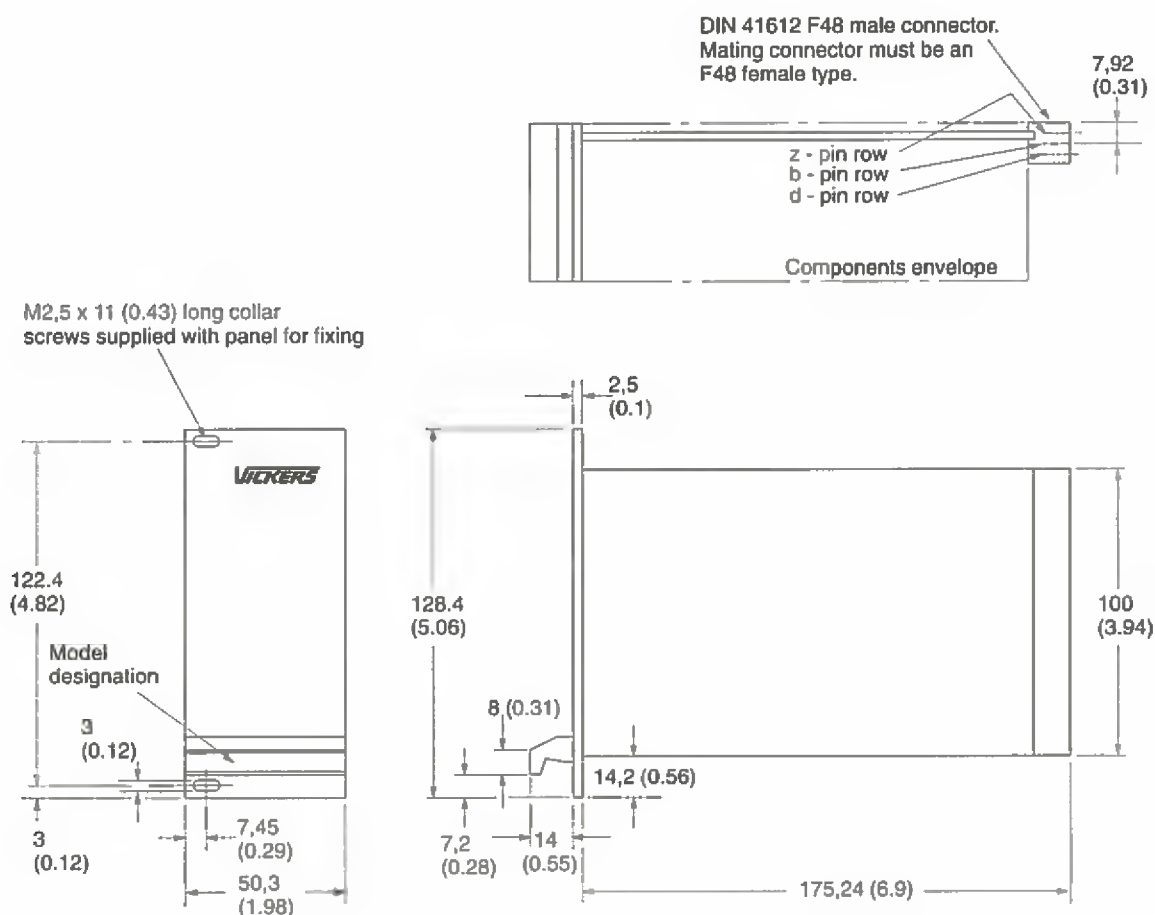
⊥ Customer's protective ground connection.

## Solenoid and LVDT Connections for Proportional Valves

Amplifier type	Solenoid with LVDT and/or for flow P to B	Solenoid without LVDT, or on pilot valve	Pilot-stage LVDT, (black plug):				Main-stage LVDT, (gray plug):			
			Pin 1	Pin 2	Pin 3	Pin 4	Pin 1	Pin 2	Pin 3	Pin 4
EEA-PAM-513-D-32	b26/b28	—	—	—	—	Not connected	—	—	—	Not connected
EEA-PAM-523-D-32	b26/b28	z26/z28	—	—	—	Not connected	—	—	—	Not connected
EEA-PAM-525-D-32	b26/b28	z26/z28	—	—	—	Not connected	—	—	—	Not connected
EEA-PAM-533-D-32	b26/b28	z26/z28	—	—	—	Not connected	b14	z22	b16	Not connected
EEA-PAM-535-D-32	b26/b28	z26/z28	—	—	—	Not connected	b14	z22	b16	Not connected
EEA-PAM-541-D-32	—	z26/z28	z14	z22	z16	Not connected	b14	z22	b16	Not connected
EEA-PAM-553-D-32	—	z26/z28	—	—	—	Not connected	b14	z22	b16	Not connected
EEA-PAM-561-D-32	—	z26/z28	—	—	—	Not connected	b14	z22	b16	Not connected
EEA-PAM-568-D-32	—	z26/z28	—	—	—	Not connected	b14	z22	b16	Not connected
EEA-PAM-571-D-32	—	z26/z28	—	—	—	Not connected	b14	z22	b16	Not connected
EEA-PAM-581-D-32	—	z26/z28	z14	z22	z16	Not connected	b14	z22	b16	Not connected

## Installation Dimensions in mm (inches)

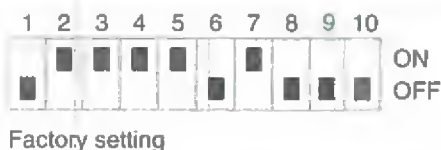
Plug-in Unit of 3U height, to IEC 297



## Application Notes

### DIL Switches

The controller is configured for the application using DIL switches, located on the board.



The DIL switch operates as follows:

Switch	ON	OFF
D1:	For sensors with 4 to 20 mA output	For sensors with $\pm 10V$ or 20 mA outputs
D2:	P-gain 2 to 50	P-gain 0,1 to 2
D6:	One-sided limitation of the integrator output. (Only useful for proportional pressure and proportional throttle valves.)	No limitations of integrator output
D7:	Inverts the controller output signal	Non-inverted signal
D8:	For sensors with 4 to 20 mA output	For sensors with $\pm 10V$ or 20 mA outputs
D9:	Inverts the ramp signal	—
D10:	Not used	—

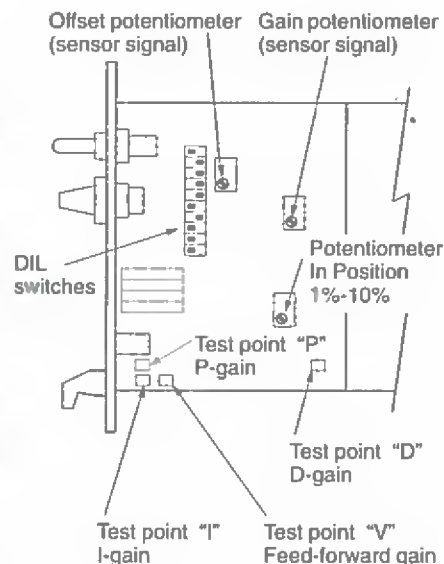
For p/Q control with automatic switch-over, connect d16 to z2 (+10V). The flow command signal (Q) is applied to the feed-forward input, d8, and the desired pressure setpoint voltage applied to a command signal input (b6/8/10 or z6/8/10). The pressure feedback sensor is connected to the sensor input d2, or d6 as required.

The pressure control loop will override the flow command to limit the pressure to the level determined by the pressure setpoint voltage. Adjust P, I and D gains for best performance.

The switches D3, D4 and D5 belong together. They limit the I output volts between 100% (10V) and 5% (0,5V) as follows:

D3	D4	D5	I-limit
ON	ON	ON	100%
ON	ON	OFF	50%
ON	OFF	ON	35%
ON	OFF	OFF	25%
OFF	ON	ON	5,9%
OFF	ON	OFF	5,8%
OFF	OFF	ON	5,3%
OFF	OFF	OFF	5,0%

### Location of User Features on PID Module



### Reconfiguration of Controller Parameters

Once the controller parameters have been optimized and set, they can be measured by means of an ohmmeter. This allows easy reconfiguration of the controller on different cards for use as spare parts or on standard machine series.

Four test points are located on the PID-module for this purpose, see diagram for locations. The resistance between the appropriate test point and ground (at the front panel monitor point) determines the controller parameters:

- P = P-gain
- I = I-gain
- D = D-gain
- V = Feed-forward gain

### Operation of the Integrated Test Mode

The basic operation of the hydraulic actuator can be tested by using the 3-position mode switch mounted on the front panel. To select different modes the toggle switch must be lifted slightly before turning it to a new position.

#### Caution:

Before setting the mode switch to either "Test valve" or "Test loop" make sure the test potentiometer is set to "0". Otherwise sudden movements of the actuator may occur.

The mode switch has three positions:

#### AUTO

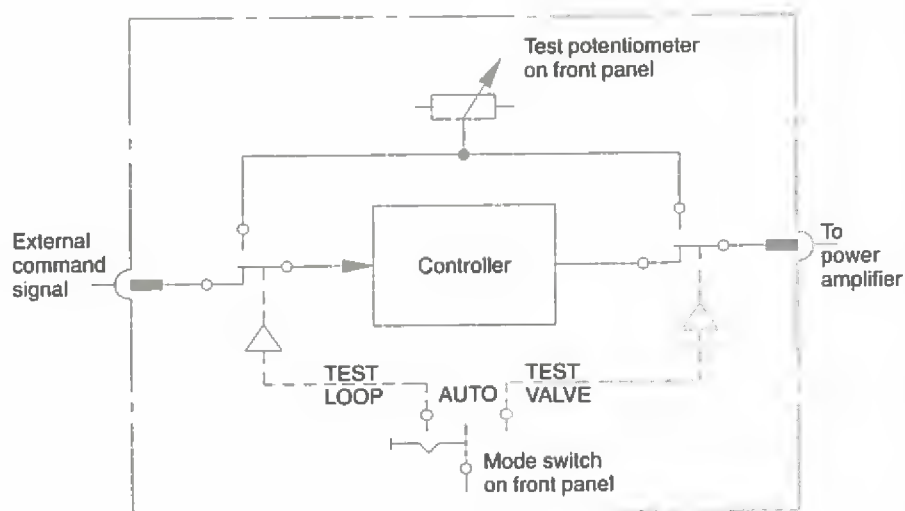
The controller operates in closed-loop mode, using the external command signal. The test potentiometer is disconnected.

#### TEST VALVE

An open-loop command signal for the valve comes directly from the potentiometer. The external input signal is disconnected. The hydraulic part of the system may be tested in this configuration.

#### TEST LOOP

The closed-loop command signal for the PID-controller comes directly from the potentiometer. The external signal input is disconnected. This configuration allows for verification of the valve polarity and the control parameters.



## Power Amplifiers with Strip Guidance Controller Modules

### EEA-PAM-5\*\*-E-32 Series

#### General Description

A strip guidance controller serves to control the position of an electro-hydraulic actuator, using optical sensors.

The controller can be used for strip-edge or strip-center guidance or stack height control.

It consists of a power amplifier for proportional valves, and an integrated module for strip guidance control.

#### Features and Benefits

- Includes all features of "A" amplifiers
- Input offset compensation
- Strip guidance control
- Voltage or current input sensor interface
- Built-in test feature

For full description of operation, see next page.

#### Front Panel

##### LEDs

- [1] 24V power supply input, green
- [2] 15V control supply output, green
- [3] Drive (solenoid) enabled, yellow
- [4] Overload, red
- [5] LVDT failure, red
- [6] Drive level to solenoid, yellow

##### Potentiometers

- [7] Deadband compensation, flow P to B
- [8] Deadband compensation, flow P to A

##### LED

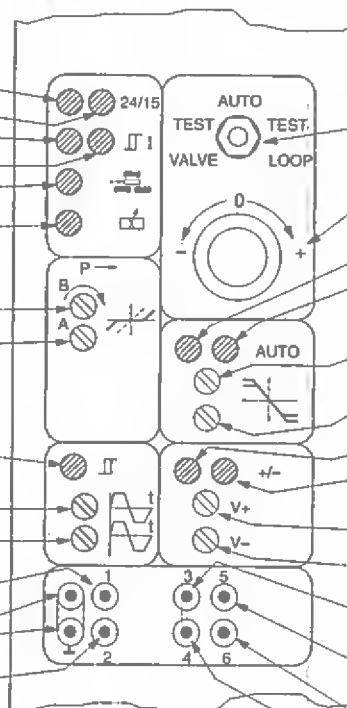
- [9] Ramps enabled, yellow

##### Potentiometers

- [10] Acceleration ramp
- [11] Deceleration ramp

##### Monitor points ■

- [12] MP1: Conditioned input signal
- [13] Common ground (0V)
- [14] MP2: LVDT (spool) position ▲



- [15] Mode switch
  - TEST VALVE setting
  - AUTO function setting
  - TEST LOOP setting

- [16] Test potentiometer

##### LEDs

- [17] Controller active, yellow
- [18] Sensor out of range, red

##### Potentiometers

- [19] Maximum closed-loop velocity +
- [20] Maximum closed-loop velocity -

##### LEDs

- [21] Open-loop command (+) active
- [22] Open-loop command (-) active

##### Potentiometers

- [23] Open-loop command +
- [24] Open-loop command -

##### Monitor points ■

- [25] MP3: Output signal of sensor with current output, non-inverting
- [26] MP5: Conditioned sensor signal,  $\pm 10V$  full scale
- [27] MP6: Controller output
- [28] MP4: Output signal of sensor with current output, inverting

▲ Solenoid current for EEA-PAM-523/525-E models.  
■ Ø2,0 mm (0.0787" dia.) sockets.



This product has been designed and tested to meet specific standards outlined in the European Electromagnetic Compatibility Directive (EMC) 89/336/EEC, amended by 91/263/EEC, 92/31/EEC and 93/68/EEC, article 5. For instructions on installation requirements to achieve effective protection levels, see this leaflet and the Installation Wiring Practices for Vickers Electronic Products leaflet 2468. Wiring practices relevant to this Directive are indicated by Electromagnetic Compatibility (EMC).

## Operation

Non-contact optical sensors measure the position of the strip edge. The output from a sensor is an electrical signal, which is fed to the strip guidance controller (signal ranges 0 to 20 mA, 4 to 20 mA, 0 to +10V, or 0 to +24V). When activated, the strip guidance controller maintains the strip edge exactly in the center of the measuring range.

If the position of the strip edge deviates from the center of the measuring range, the controller causes the actuator to move the strip edge back into position.

When closed-loop control is activated by the digital input signal "Automatic", the strip edge is moved from its current position into the measuring range of the

sensor. The maximum actuator velocity (forwards and reverse) can be set on the front panel. Whenever the strip edge leaves the measuring range of the sensor, the controller generates a digital output signal which can be processed by the machine controller.

If closed-loop control is not activated, the controller can be operated open-loop. In this case the actuator travels at the velocity set by potentiometer "V+" when digital input "set +" is activated. "V –" and digital input "set –" are used for movements in the reverse direction.

A built-in test function together with front panel monitor points, considerably simplify start-up and fault diagnosis.

## Model Codes

Amplifier model	For valves
EEA-PAM-523-E-32	KDG4V-3
EEA-PAM-525-E-32	KDG4V-5
EEA-PAM-533-E-32	KFDG4V-3
EEA-PAM-535-E-32	KFDG4V-5
EEA-PAM-541-E-32	KHDG5V-5/7/8 zero-lap
EEA-PAM-553-E-32	KSDG4V-3
EEA-PAM-561-E-32	KFDG5V-5/7
EEA-PAM-568-E-32	KFDG5V-8
EEA-PAM-581-E-32	KHDG5V-5/7/8

## Operating Data

Power supply	zbd32	See appropriate base amplifier, e.g. for EEA-PAM-535-E-32 see EEA-PAM-535-A-32
Control (output) supplies	z22	+15V for LVDTs only
Differential inputs for sensor:		
Voltage input, non-inverting	d2	+24V max., $R_i = 100\text{ k}\Omega$
Voltage input, inverting	d6	24V max., $R_i = 100\text{ k}\Omega$
Current input, non-inverting	d8	20 mA max., $R_i = 100\Omega$
Current input, inverting	d12	20 mA max., $R_i = 100\Omega$
Digital inputs (opto-isolated):		
Set +	d22	24V DC nom., 20 to 40V DC max., $R_i = 2,7\text{ k}\Omega$
Set –	d20	24V DC nom., 20 to 40V DC max., $R_i = 2,7\text{ k}\Omega$
Automatic	d18	24V DC nom., 20 to 40V DC max., $R_i = 2,7\text{ k}\Omega$
Drive enable	z24	Enable = 9,8 to 40V Disable = 0 to 4,8V or open, $R_i = 47\text{ k}\Omega$
Ramp enable	b24	Enable = 9,8 to 40V Disable = 0 to 4,8V or open, $R_i = 47\text{ k}\Omega$

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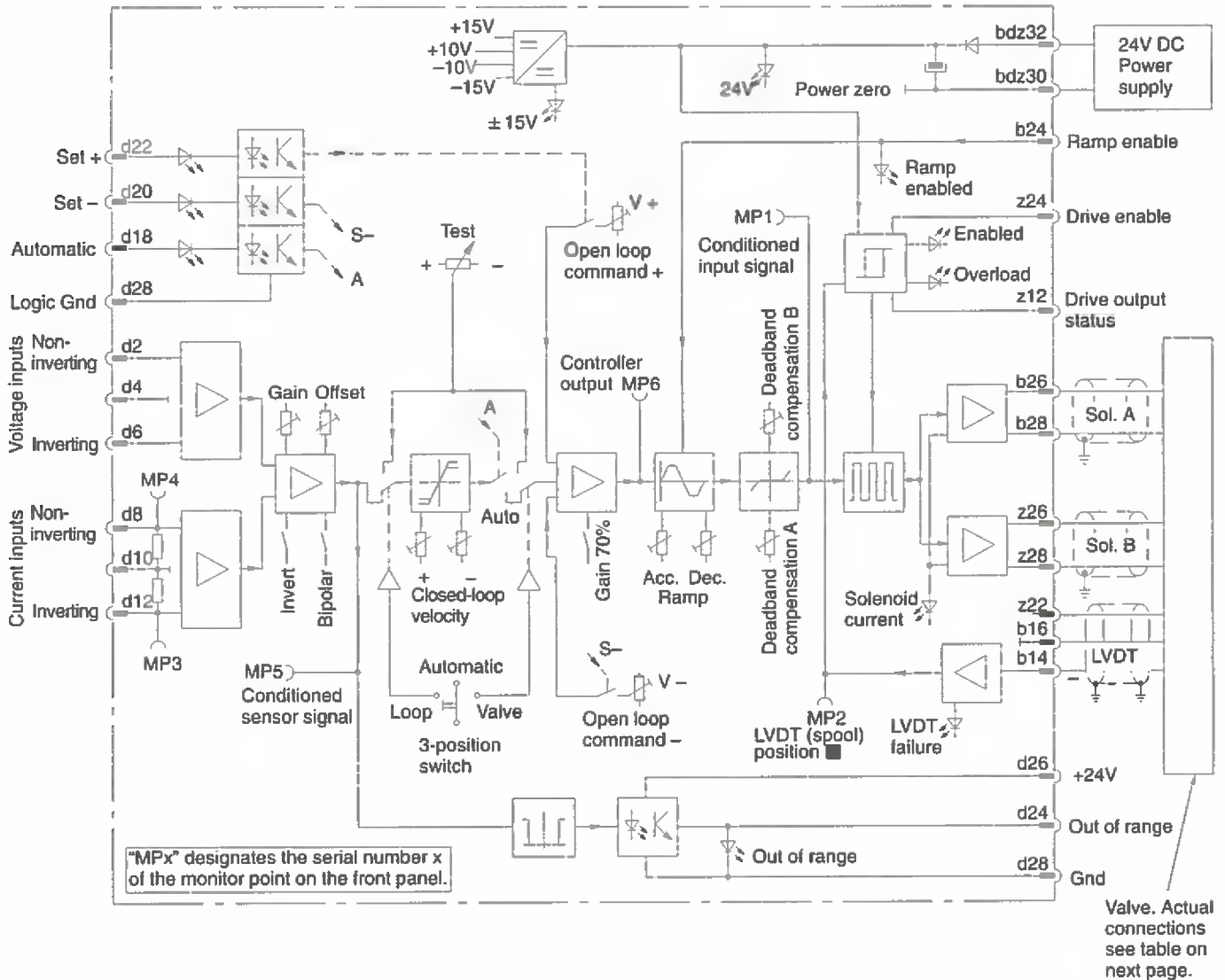
Digital output (opto-isolated): Out of range	d24	24V DC nom. Short-circuit proof. $I_{max.} = 100 \text{ mA}$
Potentiometer/s: Deadband compensation Ramp time adjustment Closed-loop velocities Open-loop command		<p>Separate controls for each direction from spool-centered position 0 to 50% of max. current</p> <p>Separate controls for acceleration and deceleration 50 ms to 5 sec</p> <p>Separate controls for forward and reverse 5 to 100%</p> <p>Separate controls for forward and reverse 0 to 100%</p>
Monitor points (Numbers corresponding to the numbering on the front panel and in the circuit diagram)		<p>MP1: Conditioned input signal, <math>\pm 10\text{V}</math></p> <p>MP2 LVDT (spool) position, <math>\pm 10\text{V}</math>▲</p> <p>MP3: Output signal of sensor with current output, non-inverting 0 to 2V = 0 to 20 mA</p> <p>MP4: Output signal of sensor with current output, inverting 0 to 2V = 0 to 20 mA</p> <p>MP5: Conditioned sensor signal, <math>\pm 10\text{V}</math></p> <p>MP6: Controller output, <math>\pm 10\text{V}</math></p> <p>All monitor points are short-circuit proof. In all cases: <math>R(out) = 10 \text{ k}\Omega</math></p>
Alarm output: Set alarm Signal	z12	<p>Enable amplifier (on pin z24) when switching power on HIGH when alarm is activated Output = Supply volts minus 2 volts <math>I = 50 \text{ mA max.}</math></p> <p>LOW when solenoid overload has occurred. (Maintained until reset) Output = 0 to <math>\pm 2</math> volts Output resistance = 50 ohms Disable and re-enable on pin z24</p>
Reset after failure		
Test facilities		<p>3-position switch for:</p> <ul style="list-style-type: none"> <li>– Valve test mode</li> <li>– Controller test mode</li> <li>– Automatic operation mode</li> </ul> <p><b>Caution:</b> Before setting the mode switch to either "Test valve" or "Test loop" ensure that the test potentiometer is set to "0", otherwise sudden movements of the actuator may occur.</p>
Operating temperature		0 to 50°C (32 to 122°F)
Storage temperature		-25 to +85°C (-13 to +185°F)
Mass		0,4 kg (0.88 lb) approx.
Installation and start-up guidelines (supplied with product)		9170
Installation wiring requirements for Vickers electronic products		2468
Application notes (available on request)		9062
Supporting products:		See catalogs:
Power unit options		2419
Electronic accessories		2460
Portable test equipment		2462 and 2315

▲ Solenoid current for EEA-PAM-523/525-E models.

# Circuit and Connections

## EEA-PAM-533/535-E example ▲

Read circuit in conjunction with that for relevant base amplifier EEA-PAM-5\*\*-A



⊕ Customer's protective ground connection.

▲ See footnote at bottom of "Application Examples".

■ Solenoid current for EEA-PAM-523/525-E models.



### Warning: Electromagnetic Compatibility (EMC)

It is necessary to ensure that the valve is wired up in accordance with the connection arrangements shown in this leaflet. For effective protection, the user's electrical cabinet, the valve subplate or manifold and the cable screens should be connected to efficient earth (ground) points. The metal 7-pin connector part no. 934939 should be used for the integral amplifier.

In all cases, both valve and cable should be kept as far away as possible from any source of electromagnetic radiation such as cables carrying heavy current, relays and certain kinds of portable radio transmitters, etc. Difficult environments could mean that extra screening may be necessary to avoid the interference.

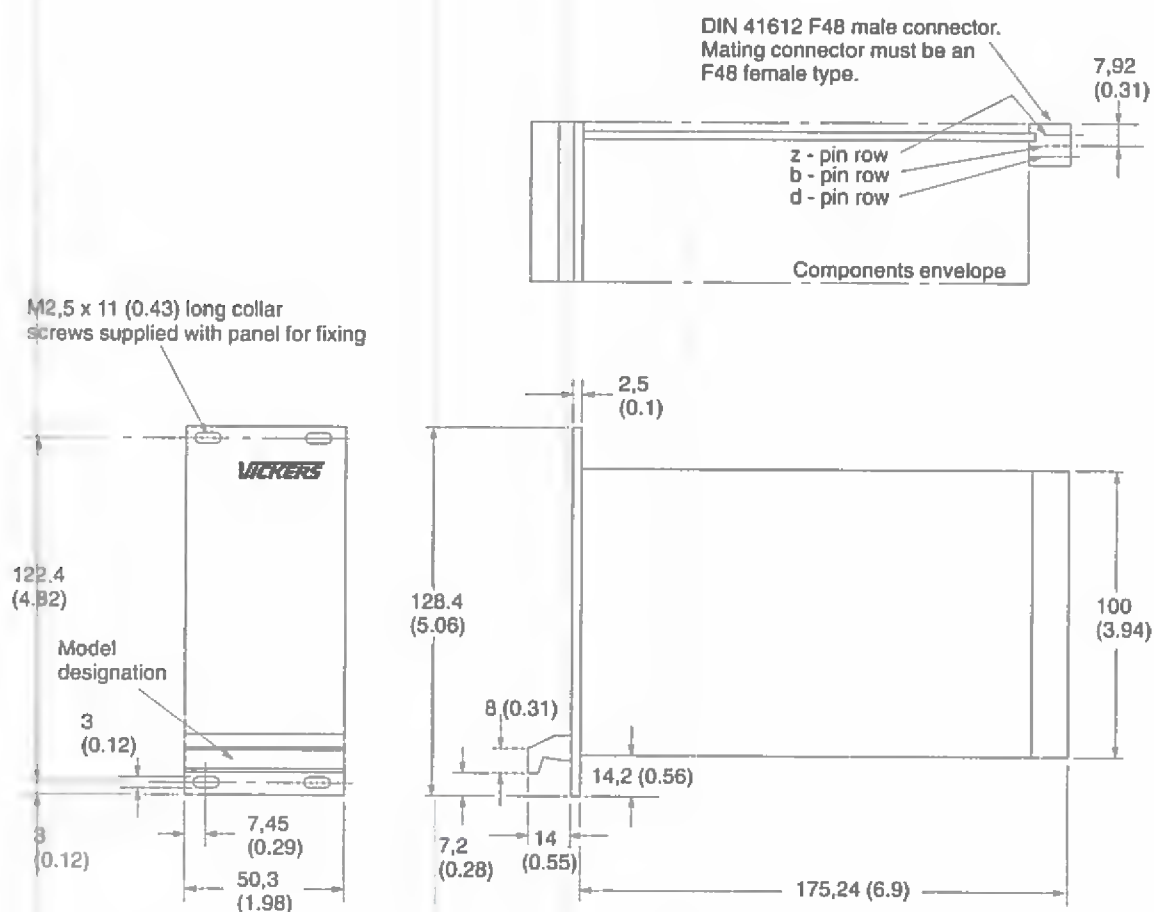
## Solenoid and LVDT Connections for Proportional Valves

Amplifier type	Solenoid with LVDT and/or for flow P to B	Solenoid without LVDT, or on pilot valve	Pilot-stage LVDT, (black plug):				Main-stage LVDT, (gray plug):			
			Pin 1	Pin 2	Pin 3	Pin 4	Pin 1	Pin 2	Pin 3	Pin 4
EEA-PAM-523-E-32	b26/b28	z26/z28	—	—	—	Not connected	—	—	—	Not connected
EEA-PAM-525-E-32	b26/b28	z26/z28	—	—	—	Not connected	—	—	—	Not connected
EEA-PAM-533-E-32	b26/b28	z26/z28	—	—	—	Not connected	b14	z22	b16	Not connected
EEA-PAM-535-E-32	b26/b28	z26/z28	—	—	—	Not connected	b14	z22	b16	Not connected
EEA-PAM-541-E-32	—	z26/z28	z14	z22	z16	Not connected	b14	z22	b16	Not connected
EEA-PAM-553-E-32	—	z26/z28	—	—	—	Not connected	b14	z22	b16	Not connected
EEA-PAM-561-E-32	—	z26/z28	—	—	—	Not connected	b14	z22	b16	Not connected
EEA-PAM-568-E-32	—	z26/z28	—	—	—	Not connected	b14	z22	b16	Not connected
EEA-PAM-581-E-32	—	z26/z28	z14	z22	z16	Not connected	b14	z22	b16	Not connected

### Installation Dimensions in mm (inches)

Plug-In Unit of 3U Height, to IEC 297

3rd angle projection

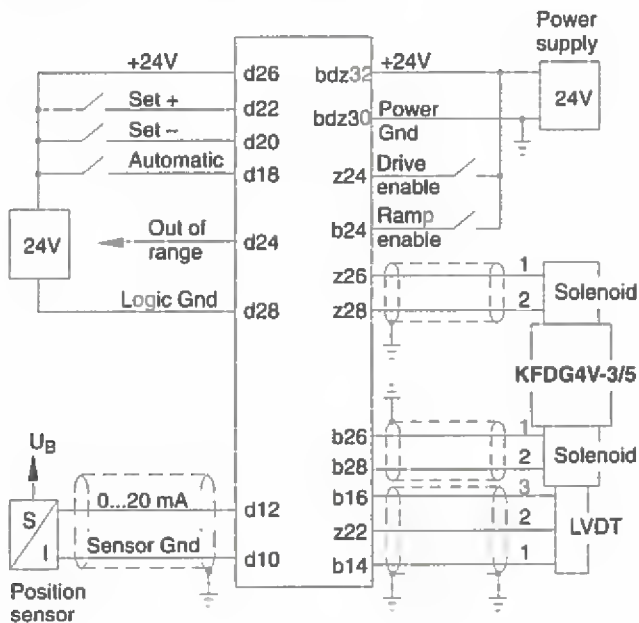


# Application Examples

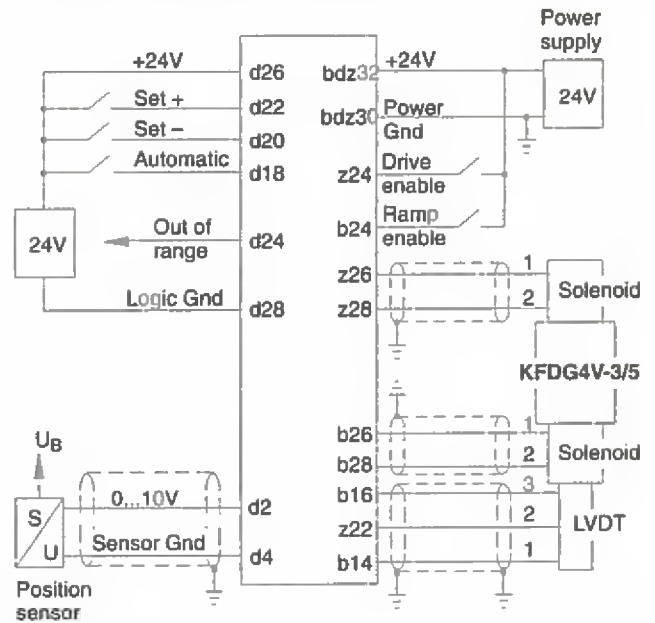
## EEA-PAM-533/535-E amplifiers with KFDG4V-3/5 valves ▲

### Strip guidance control, stack height control

#### Position sensor with current output

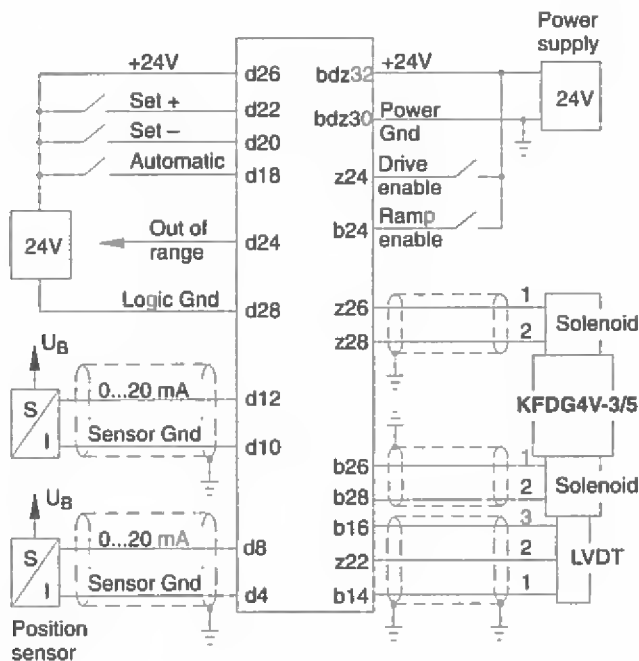


#### Position sensor with voltage output

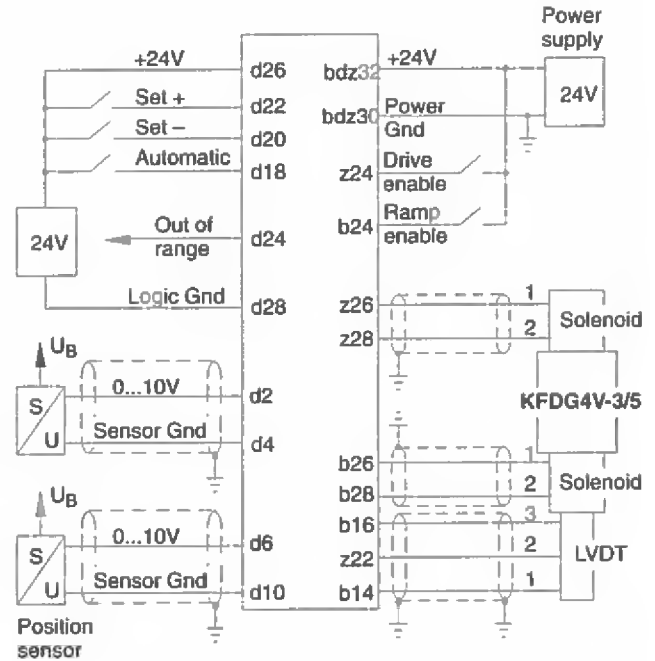


### Strip-center guidance control

#### Position sensor with current output



#### Position sensor with voltage output



▲ Other amplifier/valve combinations differ in respect to the LVDT and solenoid connections; see catalog 2464 for the relevant base amplifier EEA-PAM-5\*\*\*-A-32.

⏏ Customer's protective ground connection.

## Power Amplifiers with CNC Adaptation Modules

### EEA-PAM-5\*\*-F-32 Series

#### General Description

The EEA-PAM-5\*\*-F-32 Eurocards are power amplifiers with integrated CNC adaptation modules. Each card replaces two conventional electronic cards.

These power amplifiers are used for high accuracy positioning systems with inexpensive standard proportional valves and CNC axis or PLC position controls.

#### Features and Benefits

- Includes all features of "A" amplifiers
- Hysteresis compensation for valves with/without feedback
- Enhanced deadband adjustment for closed-loop position control using valves with overlap
- This particular configuration reduces the amount of external wiring, saves space in the rack enclosure and requires only one 24V power supply
- Smooth transition between the overlap region and working region
- Low cost, high accuracy positioning systems with overlapped proportional valves. Non-linearities and inconsistencies (friction) in the overlap region are compensated by the electronic linearization
- Simple set-up procedure
- A built-in test function significantly simplifies commissioning (start-up) and fault-diagnosis

#### Front Panel

##### LEDs

- [1] 24V power supply input, green
- [2] 15V control supply output, green
- [3] Drive (solenoid) enabled, yellow
- [4] Overload, red
- [5] LVDT failure, red
- [6] Drive level to solenoid, yellow

##### Potentiometer

- [7] Offset

##### LED

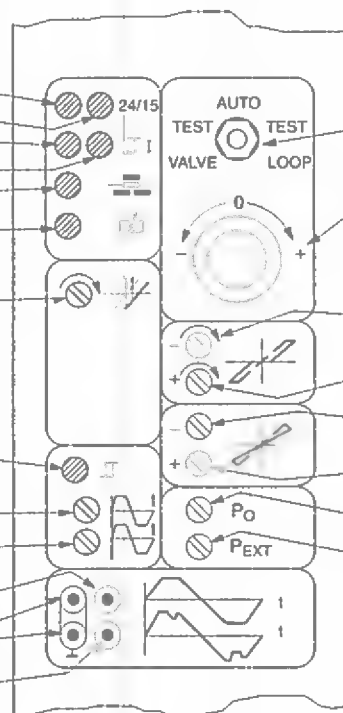
- [8] Ramps enabled, yellow

##### Potentiometers

- [9] Acceleration ramp
- [10] Deceleration ramp

##### Monitor points ■

- [11] MP1: Conditioned command signal
- [12] Common ground (0V)
- [13] MP2: LVDT (spool) position ▲



- [14] Mode switch
  - TEST VALVE setting
  - AUTO function setting
  - TEST LOOP setting
- [15] Test potentiometer

- Potentiometers**
- [16] Deadband compensation
- [17] Deadband compensation
- [18] Gain
- [19] Gain
- [20] Deadband gain
- [21] P-gain controller

■ Ø2,0 mm (0,0787" dia.) sockets.

▲ Solenoid current for EEA-PAM-523/525-F models.



This product has been designed and tested to meet specific standards outlined in the European Electromagnetic Compatibility Directive (EMC) 89/336/EEC, amended by 91/263/EEC, 92/31/EEC and 93/68/EEC, article 5. For instructions on installation requirements to achieve effective protection levels, see this leaflet and the Installation Wiring Practices for Vickers Electronic Products leaflet 2468. Wiring practices relevant to this Directive are indicated by Electromagnetic Compatibility (EMC).

GB-2476A

## Model Codes

Amplifier model	For valves
EEA-PAM-523-F-32	KDG4V-3
EEA-PAM-525-F-32	KDG4V-5
EEA-PAM-533-F-32	KFDG4V-3
EEA-PAM-535-F-32	KFDG4V-5
EEA-PAM-561-F-32	KFDG5V-5/7
EEA-PAM-568-F-32	KFDG5V-8
EEA-PAM-581-F-32	KHDG5V-5/7/8

## Operating Data

Power (input) supply	bdz32	See appropriate base amplifier, e.g. for EEA-PAM-535-F-32 see EEA-PAM-535-A-32
Control (output) supplies	z22	+15V for LVDTs only
Reference voltages	z2 b2	+10V x 5 mA -10V x 5 mA
Analog inputs:		
Command inputs		
Direct-voltage inputs	b6, b8, b10, z8	
Inverting-voltage input	z10	
Voltage range		± 10V
Input impedance (voltage)		47 kΩ
Current input	d28	
Current range		± 20 mA
Input impedance (current)		100Ω
Input ramp		Can be inverted using jumper on plug X30 on circuit board.
Voltage range		± 10V (see circuit diagram on page 4)
Input impedance		10 kΩ
Velocity demand signal	d10, d16	
Voltage range		± 10V
Input impedance		15 kΩ
Digital inputs:		
Drive enable (power available to solenoid)	z24	
Ramps enable	b24	
Enabled		17 to 40V
Disabled		0 to 3,5V
Load current		≤ 10 mA
Analog outputs:		
P-controller output		
Voltage range	d12	± 10V
Load impedance		≥ 10 kΩ; short-circuit proof
Output ramp generator	d26	
Voltage range		± 10V
Load impedance		≥ 10 kΩ; short-circuit proof

Continued on next page



Alarm output: Set alarm Signal	z12	<p>Enable amplifier (on pin z24) when switching power on. HIGH when alarm is activated. Output = Supply volts minus 2 volts. I = 50 mA max. LOW when solenoid overload has occurred. (Maintained until reset). Output = 0 to +/-2 volts. Output resistance = 50 ohms. Disable and re-enable on pin z24.</p>
Reset after failure		
Potentiometers: Deadband compensation, separate control for each solenoid Gain, separate control for each solenoid P <sub>0</sub> -Deadband gain P <sub>EXT</sub> -Gain controller: Without link Link	d18 to d20	<p>0 to 50% 40 to 90% 15 to 43 times 0,1 to 5 times 2 to 100 times</p>
Integrated P-controller		<p>The input circuit of the power amplifier card is used as a differential amplifier between the demand and feedback signals. The ramp signal generator can be used as profile generator.</p> <p><b>Caution:</b> When using "TEST LOOP" the command signal has to be connected to d8, and d14 has to be connected to the command signal input of the input stage.</p>
Hysteresis compensation: Link	d2 to d6	For KDG4V-* valves only
Monitor points: Conditioned command signal power amplifier LVDT (spool) position ▲ Voltage range Monitor point impedance	MP1 MP2	<p>± 10V 10 kΩ</p>
Ambient conditions: Storage temperature range Operating temperature range		<p>-25 to +85°C (-13 to +185°F) 0 to 50°C (32 to 122°F)</p>
Mass		0,4 kg (0.88 lb) approx.
Installation and start-up guidelines (supplied with product) Installation wiring requirements for Vickers electronic products Application notes (available on request)		<p>9171 2468 9059</p>
Integrated test modes		See three pages on
Supporting products: Power supply unit options Electronic accessories Portable test equipment		<p>See catalogs: 2419 2460 2462 and 2315</p>

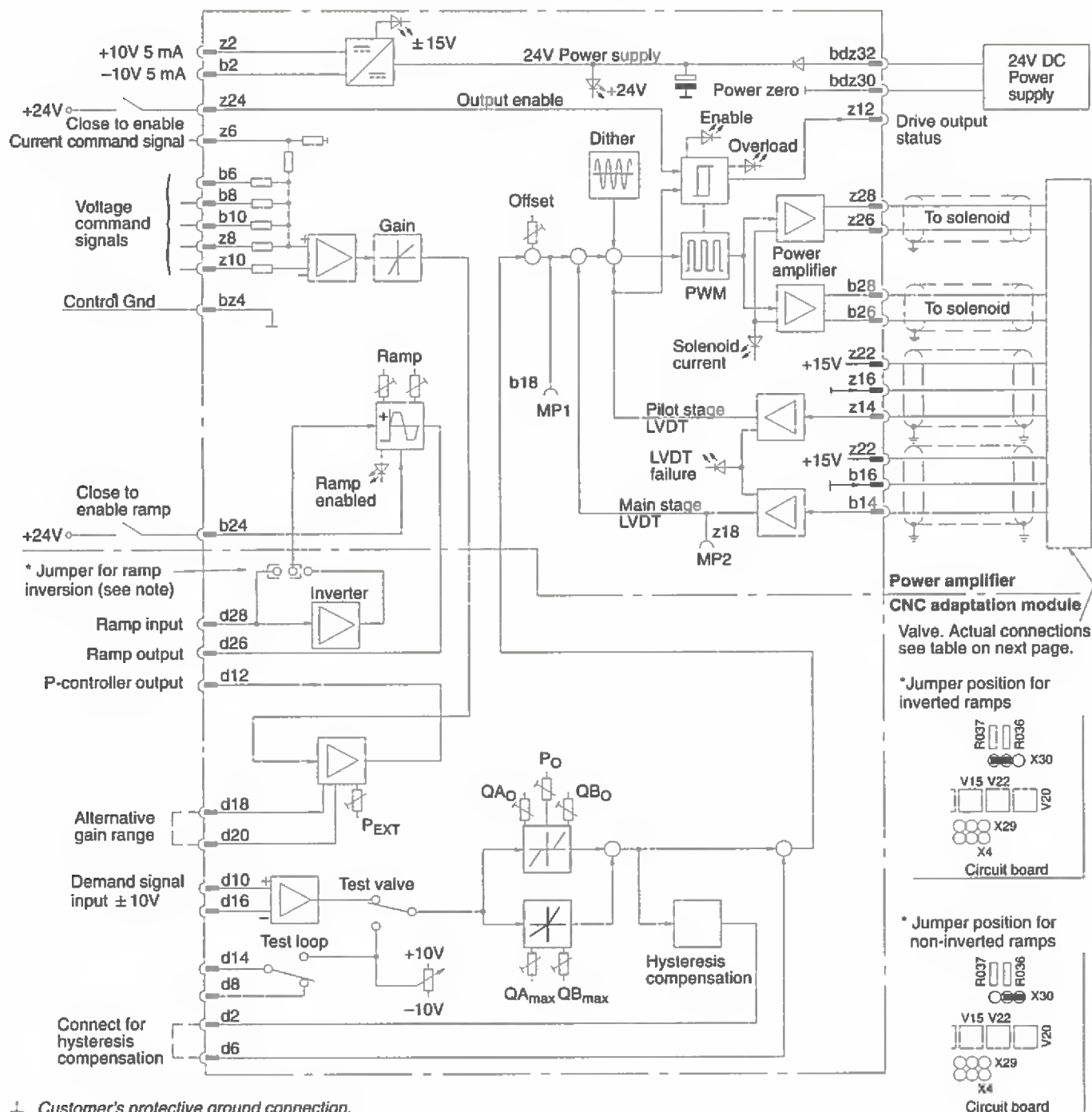
▲ Solenoid current for EEA-PAM-523/525-F models.



# Circuit and Connections

EEA-PAM-5\*\*-F-32

Read circuit in conjunction with that for relevant base amplifier EEA-PAM-5\*\*-A



## Warning: Electromagnetic Compatibility (EMC)

It is necessary to ensure that the valve is wired up in accordance with the connection arrangements shown in this leaflet. For effective protection, the user's electrical cabinet, the valve subplate or manifold and the cable screens should be connected to efficient earth (ground) points. The metal 7-pin connector part no. 934939 should be used for the integral amplifier.

In all cases, both valve and cable should be kept as far away as possible from any source of electromagnetic radiation such as cables carrying heavy current, relays and certain kinds of portable radio transmitters, etc. Difficult environments could mean that extra screening may be necessary to avoid the interference.

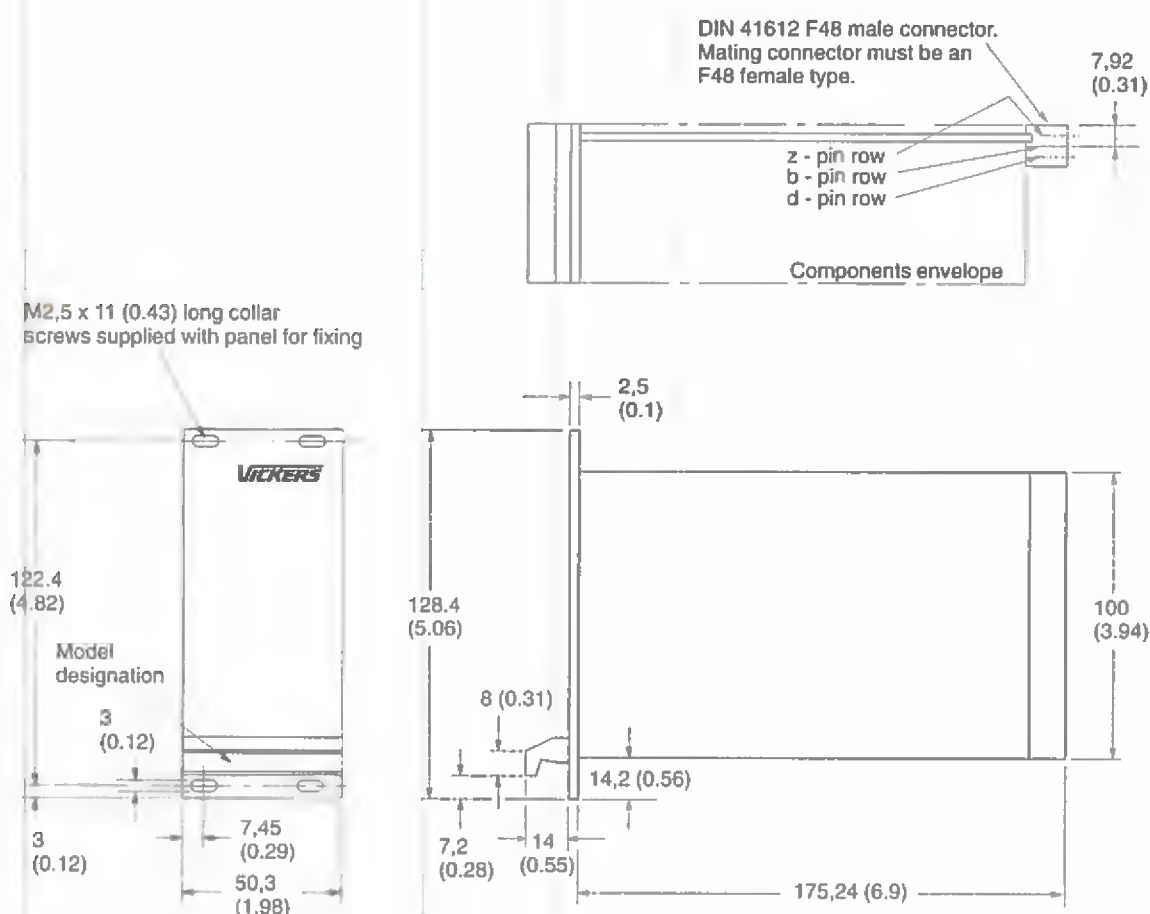
## Solenoid and LVDT Connections for Proportional Valves

Amplifier type	Solenoid with LVDT and/or for flow P to B	Solenoid without LVDT, or on pilot valve	Pilot-stage LVDT, (black plug):				Main-stage LVDT, (gray plug):			
			Pin 1	Pin 2	Pin 3	Pin 4	Pin 1	Pin 2	Pin 3	Pin 4
EEA-PAM-523-F-32	b26/b28	z26/z28	–	–	–	Not connected	–	–	–	Not connected
EEA-PAM-525-F-32	b26/b28	z26/z28	–	–	–	Not connected	–	–	–	Not connected
EEA-PAM-533-F-32	b26/b28	z26/z28	–	–	–	Not connected	b14	z22	b16	Not connected
EEA-PAM-535-F-32	b26/b28	z26/z28	–	–	–	Not connected	b14	z22	b16	Not connected
EEA-PAM-561-F-32	–	z26/z28	–	–	–	Not connected	b14	z22	b16	Not connected
EEA-PAM-568-F-32	–	z26/z28	–	–	–	Not connected	b14	z22	b16	Not connected
EEA-PAM-581-F-32	–	z26/z28	z14	z22	z16	Not connected	b14	z22	b16	Not connected

### Installation Dimensions in mm (inches)

Plug-in Unit, of 3U Height, to IEC 297

3rd angle projection



## Operation of the Integrated Test Mode

The basic operation of the hydraulic actuator can be tested by using the 3-position mode switch mounted on the front panel. To select different modes the toggle switch must be lifted slightly before moving to a new position.

### Caution:

Before setting the mode switch to either "Test valve" or "Test loop" make sure the test potentiometer is set to "0". Otherwise sudden movements of the actuator may occur.

The mode switch has three positions:  
**AUTO**

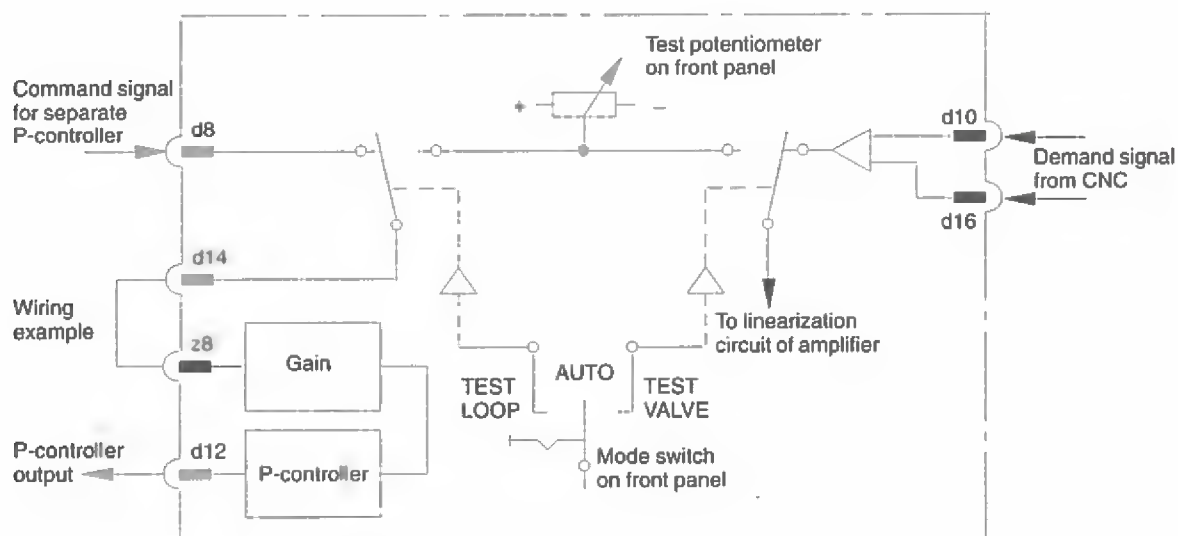
The controller operates in closed-loop mode, using the external command signal. The test potentiometer is disconnected.

### TEST VALVE

An open-loop command signal for the valve comes directly from the potentiometer. The external input signal is disconnected. The hydraulic part of the system may be tested in this configuration.

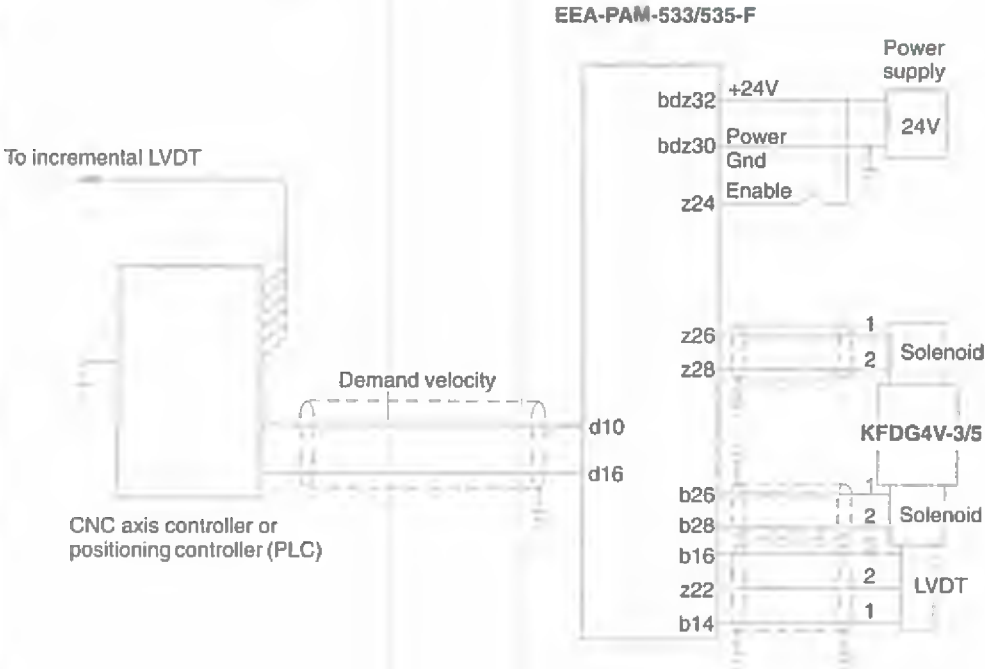
### TEST LOOP

The test potentiometer can be used to drive the separate P-controller, if "Test loop" (closed spool) is selected. The external input signal is disconnected. See wiring example. "Test loop" is usable only if the separate P-controller is used.



# Application Example

Positioning module with CNC axis controller



Customer's protective ground connection.

## Power Amplifiers for Proportional Valves

### EEA-PAM-520-A-14 Design EEA-PAM-525-A-14 Design

EEA-PAM-520-A-14 for use with valve types:  
KD/TG4V-3(S)---H7, 6\* series  
EEA-PAM-525-A-14 for use with valve types:  
KD/TG4V-5---H\*, 3\* series

### General Description

These basic amplifiers are designed for driving Vickers type KDG4V-3/5 and KTG4V-3/5 non-feedback proportional valves in applications requiring only one (adjustable) ramp setting for both acceleration and deceleration. Two pulse-width-modulated power output drives cater for one double solenoid valve (models KDG4V) or one or two single solenoid valves (models KTG4V).

Analog command input signals can be non-inverting current, or non-inverting, inverting or differential voltages. The amplifier requires a power supply of 24V DC and is enabled by a 24V logic signal. The ramp is normally enabled but can be selectively disabled by suitable wiring to an external switch.

The amplifier front panel contains LEDs showing the status of power, control supply and outputs. Potentiometers for adjusting ramp, deadband compensation and gain are also mounted in the front panel.

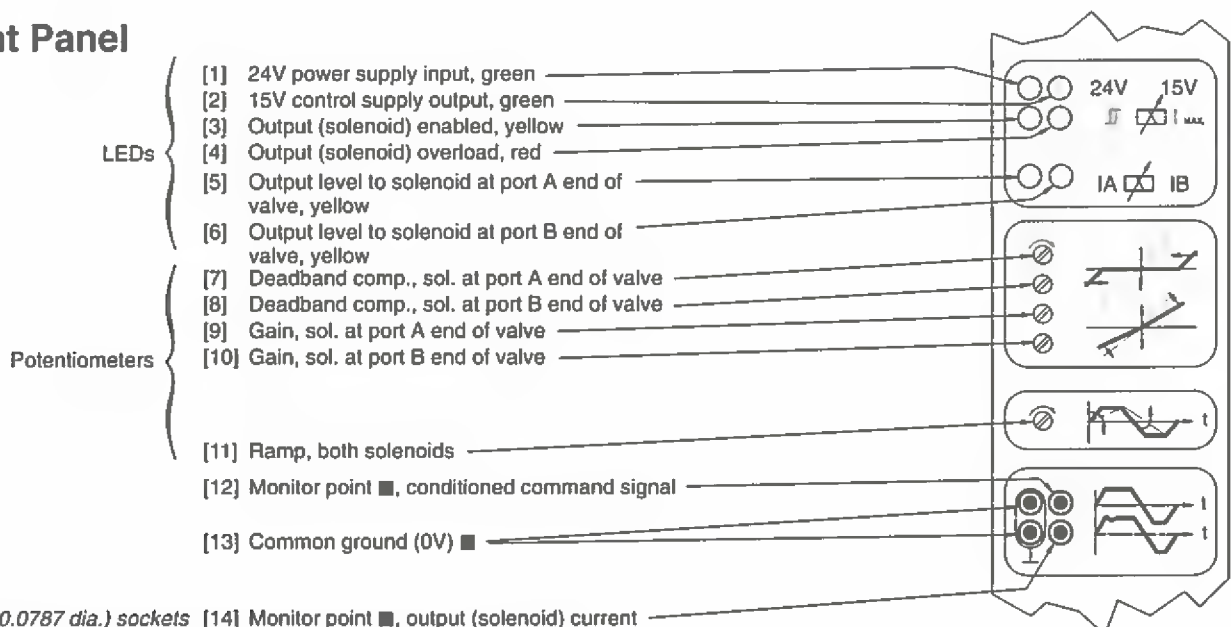
### Features

- Basic valve amplifier
- Voltage and current command signals
- 1 ramp for acceleration and deceleration
- 24V DC power supply
- Pulse-width-modulated coil drives

### New 14-design Features

- Wider supply voltage range plus increased tolerance to ripple
- Low supply voltage protection
- Additional monitor points on edge connector
- Gain re-positioned in circuitry to give:
  - Ramp setting unaffected by gain adjustment
  - Constant trigger voltage for deadband compensation

### Front Panel



#### Warning: Electromagnetic Compatibility (EMC)

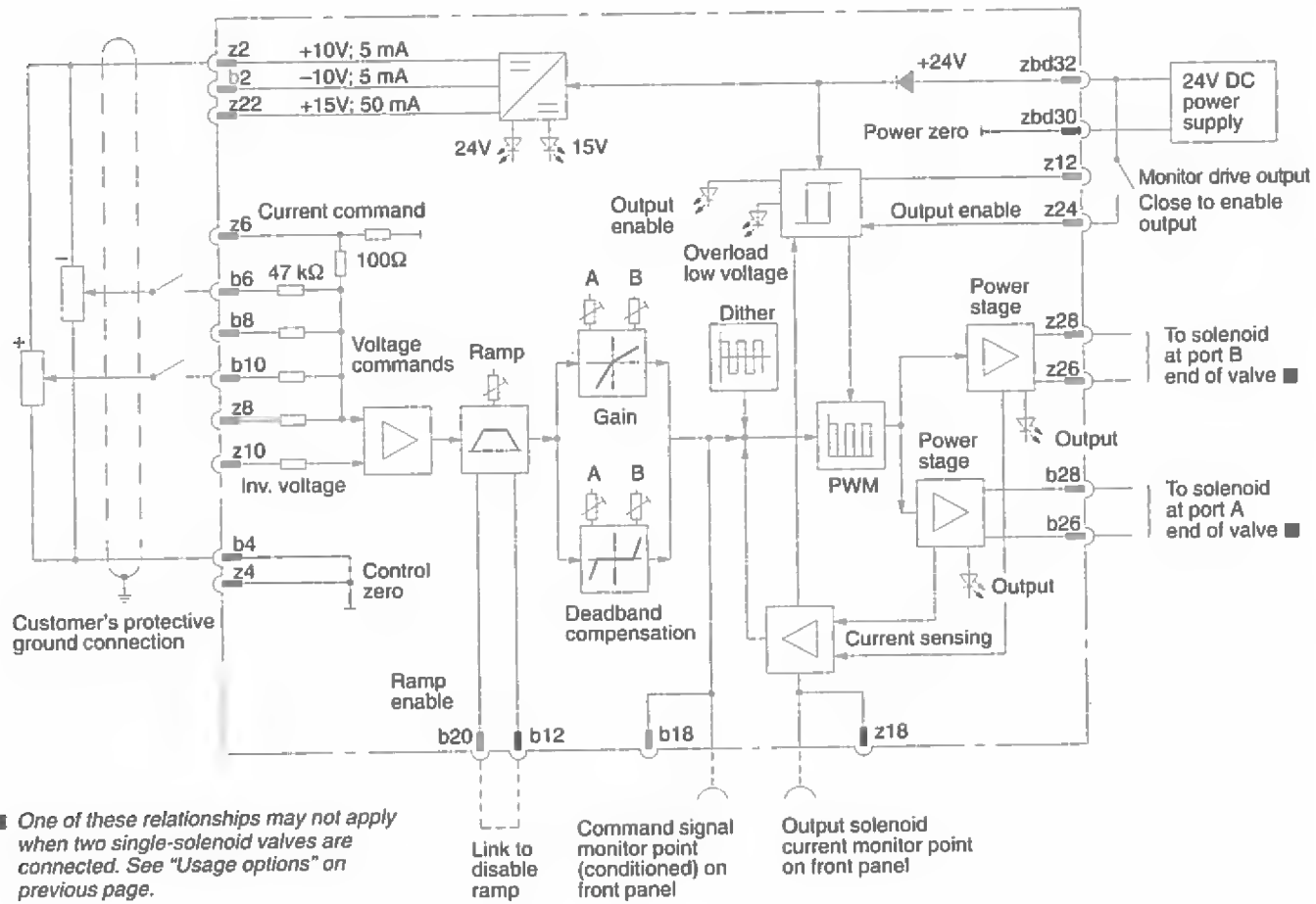
This product does not conform to the European Community directives for electromagnetic compatibility (EMC). It is only suitable for use within the European Economic Area in a sealed electromagnetic environment or as a spare for an existing machine. (Ref. UK Electromagnetic Compatibility Regulations 14 & 18, 1995.)

## Operating Data

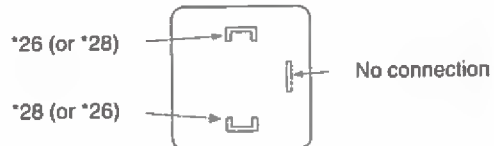
Usage options, per size of valve and related amplifier		With one double-solenoid valve With one single-solenoid valve With two single-solenoid valves if only one solenoid will be energized at any one time
Power (input) supply		20 to 34V DC x 40W max. 24V DC nominal <4V pk-to-pk ripple Amplifier shuts down below 19V
Control (output) supplies:	z22	+15V x 50 mA max.
	z2	+10V x 5 mA max.
	b2	-10V x 5 mA max.
Command signal inputs:		
Direct voltage pins	b8, b6, z8, b10	
Inverting voltage pin	z10	
Voltage range		± 10V
Input impedance (voltage)		47 kΩ
Current pin	z6	
Current range		± 20 mA
Input impedance (current)		100Ω
Deadband compensation, separate controls for two solenoids:		
Factory setting		25% of max. solenoid current ▲
Adjustment per solenoid		0 to 50% of max. current ▲
Gain, separate controls for two solenoids:		
Factory setting		Max. solenoid current at 10V ▲
Adjustment per solenoid		1,9 to 20% of max. current per 1 volt ▲
Ramp time adjustment, linear:		
Factory setting		Max. time
Adjustment per solenoid		50 ms to 2s, under pre-set deadband compensation and gain conditions specified above
Dither		Factory-set
Overload protection, factory-set		Automatic reset when fault removed
Output enabled (power available to solenoid)	z24	Apply 10 to 30V (6.8 kΩ)
Output disabled (no power output to solenoid)	z24	Apply ≤0,8V or open circuit
Ramp enabled (machine actuator acceleration and deceleration limited by ramp potentiometer)	b12, b20	Open circuit between b20 and b12
Ramp disabled (fastest acceleration and deceleration of machine actuator; ramp circuit bypassed)	b12, b20	Link b20 to b12
Command signal monitor point		± 5V for ± 100% output
Output current monitor point	front panel and z18	1 V/A
Monitor point impedance	front panel and b18	10 kΩ
Monitor point protection		Short-circuit protected
Ambient temperature range		0 to 50°C (32 to 122°F)
Mass		0,2 kg (0.44 lb)
Supporting products:		See catalogs:
Power supply unit options		2419
Electronic accessories		2460
Portable test equipment		2462 and 2315

▲ From null position

# Circuit and Connections



## Solenoid Connections



Note: Connections *not* polarity sensitive

## Command Signals and Outputs

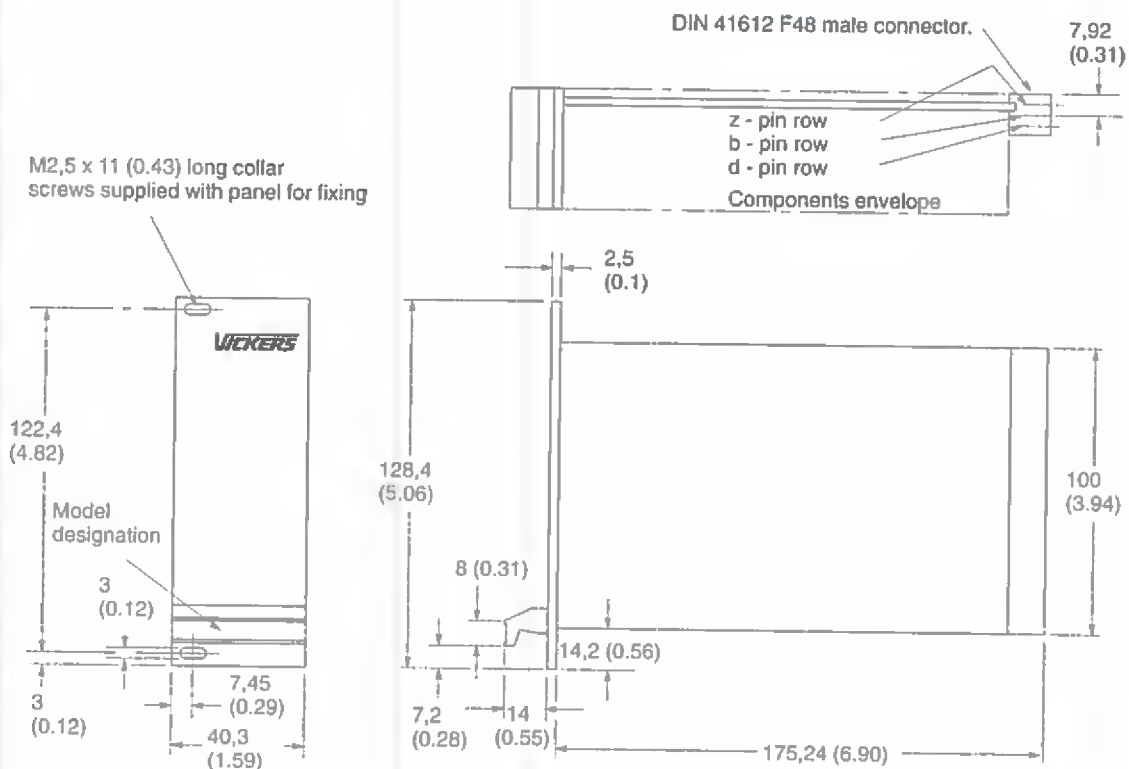
Command signals			Secondary pins ref.	Driven output pins	Valve flow
Type	Input pins				
	Ref.	Signal polarity			
Non-inverting voltages	b6/8/10 or z8	+	bz4	b26/28	P-B
		−		z26/28	P-A
Non-inverting current	z6	+		b26/28	P-B
		−		z26/28	P-A
Inverting voltage	z10	−	Link <i>one</i> of b6/8/10 or z8 to bz4	b26/28	P-B
		+		z26/28	P-A
Differential voltage		−	One of b6/8/10 or z8	b26/28	P-B
				+	z26/28
	One of b6/8/10 or z8	+	z10	b26/28	P-B
		−		z26/28	P-A



# Installation Dimensions in mm (inches)

Plug-in Unit of 3U Height, to IEC 297

3rd angle projection



## Power Amplifiers for Proportional Valves

### EEA-PAM-56\*-A-14 Design

**EEA-PAM-561-A-14** for use with valve types:  
KDG5V-5, 3\* and KDG5V-7, 1\* series  
**EEA-PAM-568-A-14** for use with valve types:  
KDG5V-8, 1\* series

### General Description

This basic amplifier is designed for driving Vickers type KFDG5V-5/7/8, 2-stage proportional valves in applications requiring only one (adjustable) ramp setting for both acceleration and deceleration.

Analog command input signals can be non-inverting current, or non-inverting, inverting or differential voltages. The amplifier requires a power supply of 24V DC and is enabled by a 24V logic signal.

The ramp is normally enabled but can be selectively disabled by suitable wiring to an external switch.

The amplifier front panel contains LEDs showing the status of power, control supply and outputs. Potentiometers for adjusting ramp, deadband compensation and gain are also mounted in the front panel.

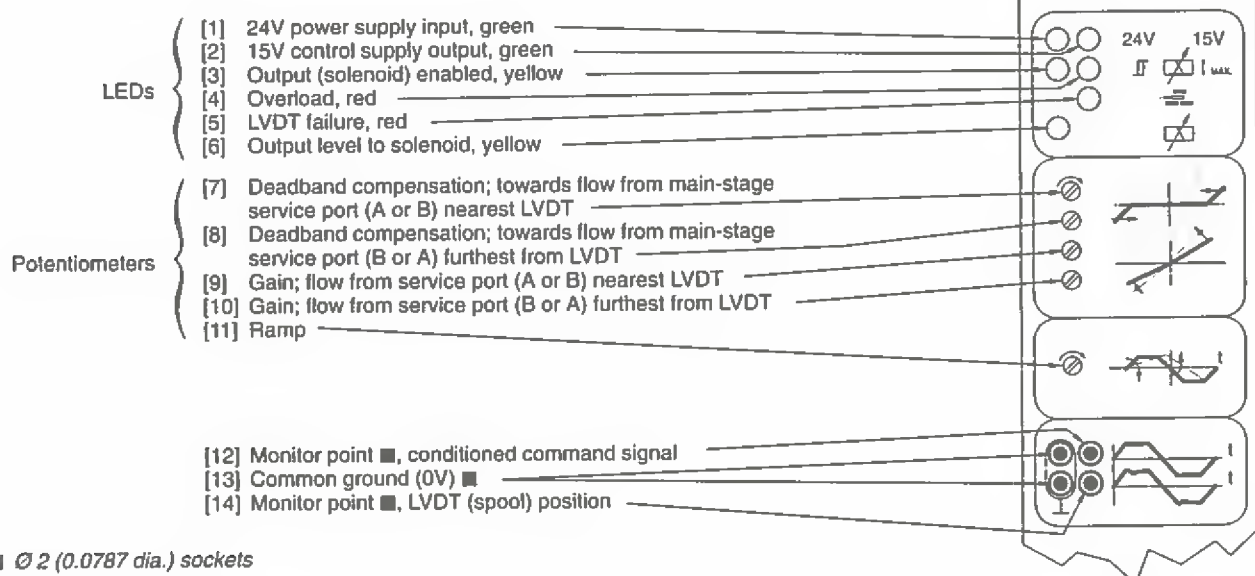
### Features

- Basic valve amplifier
- Voltage and current command signals
- 1 ramp for acceleration and deceleration
- 24V DC power supply
- Pulse-width-modulated coil drives

### New 14-design Features

- Wider supply voltage range plus increased tolerance to ripple
- Low supply voltage protection
- Additional monitor points on edge connector
- Gain re-positioned in circuitry to give:
  - Ramp setting unaffected by gain adjustment
  - Constant trigger voltage for deadband compensation

### Front Panel

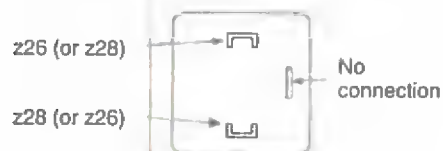


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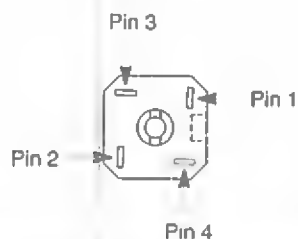
## Valve Wiring Connections

### Solenoid Connections



Note: Connections *not* polarity sensitive

### LVDT Connections



LVDT plug pin	Amplifier pin
1	b14
2	z22
3	b16
4	Not connected

## Operating Data

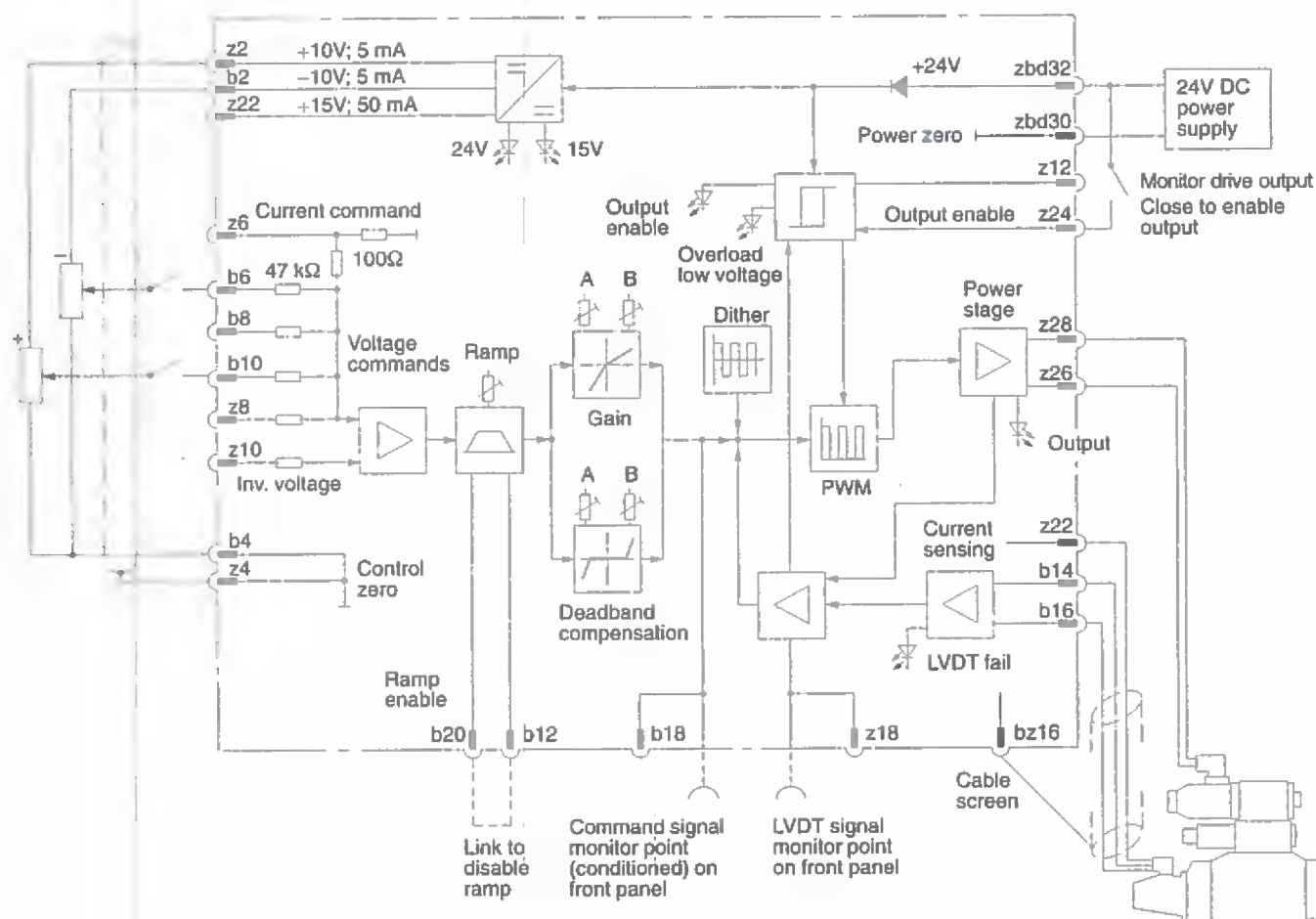
Power (input) supply	20 to 34V DC x 40W max. 24V DC nominal <4V pk-to-pk ripple Amplifier shuts down below 19V
Control (output) supplies:	z22 +15V x 50 mA max. in addition to LVDT demand z2 +10V x 5 mA max. b2 -10V x 5 mA max.
Command signal inputs:	
Direct voltage pins	b8, b6, z8, b10
Inverting voltage pin	z10
Voltage range	± 10V
Input impedance (voltage)	47 kΩ
Current pin	z6
Current range	± 20 mA
Input impedance (current)	100Ω
Standing solenoid current at zero command signal	1,4A
Note: A positive signal to a non-inverting signal pin reduces solenoid current	
Deadband compensation, separate controls for each direction from spool-centered position:	
Factory setting	10% of max. stroke ▲
Adjustment per direction from centered position	0 to 50% of max. stroke ▲
Gain, separate controls for each direction from spool-centered position:	
Factory setting	Max. spool stroke at 10V command signal ▲
Adjustment per direction from centered position	1,9 to 20% of max. spool stroke per 1 volt ▲
Ramp time adjustment, linear:	
Factory setting	Max. time
Adjustment range	50 ms to 2s, under pre-set deadband compensation and gain conditions specified above
Dither	Factory-set
Feedback from LVDT to b14	4 to 20 mA (100Ω)
Overload protection, factory-set	Automatic reset when fault removed
Output enabled (power available to solenoid)	z24 Apply 10 to 30V (6.8 kΩ)
Output disabled (no power output to solenoid)	z24 Apply ≤ 0,8V or open circuit
Ramp enabled (machine actuator acceleration and deceleration limited by ramp potentiometer)	b12, b20 Open circuit between b20 and b12

▲ From spool-centered position

Continued on next page

Ramp disabled (fastest acceleration and deceleration of machine actuator; ramp circuit bypassed)      b12, b20	Link b20 to b12
Command signal monitor point	$\pm 5V$ full scale. Command signal conditioned by deadband compensation, gain and ramp functions
Spool position monitor point front panel and z18	$\pm 5V$ full scale
Monitor point impedance front panel and b18	10 k $\Omega$
Monitor point protection	Short-circuit protected
Output point to alarm indicator      z12	>+6V when enabled <-6V when disabled
Ambient temperature range	0 to 50°C (32 to 122°F)
Mass	0,22 kg (0.48 lb)
Supporting products: Power supply unit options Electronic accessories Portable test equipment	See catalogs: 2419 2460 2462 and 2315

## Circuit and Connections



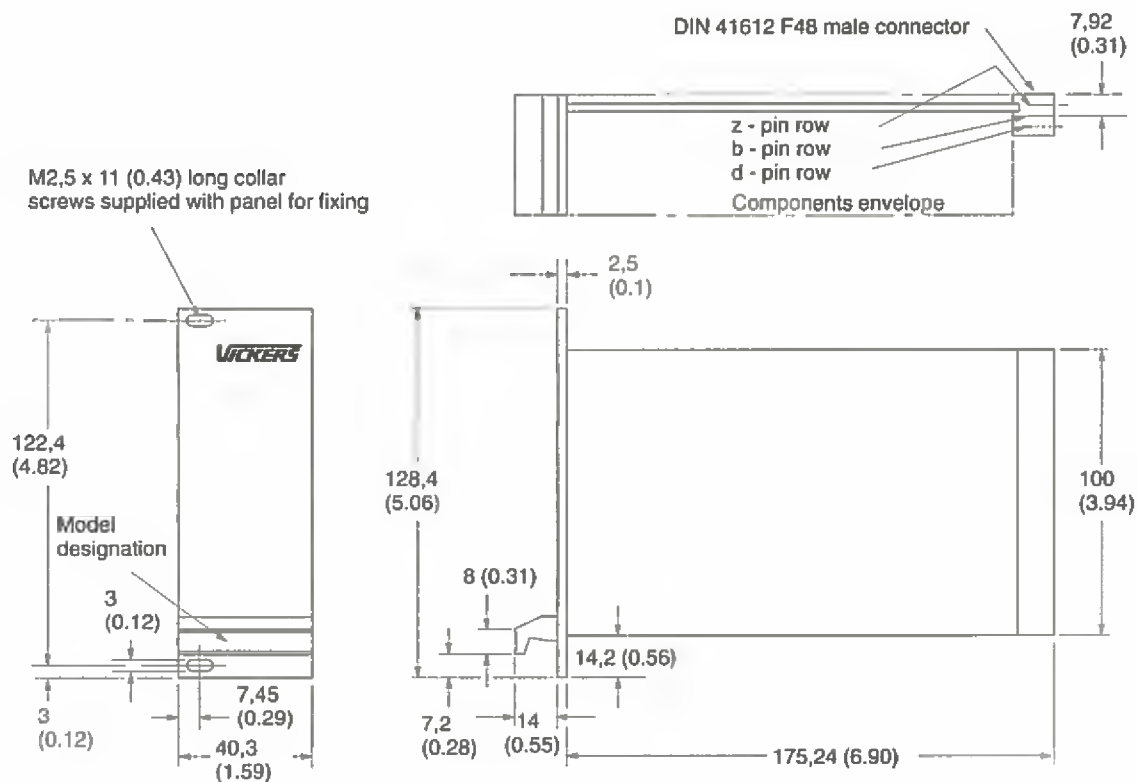
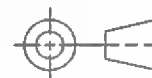
### Command Signals and Outputs

Command signals and outputs					
Command signals				Valve flow	
Type		Input pins	Secondary pins ref.		
	Ref.	Signal polarity			
Non-inverting voltages	b6/8/10 or z8	+	bz4	P-B	
		−		P-A	
Non-inverting current	z6	+		P-B	
		−		P-A	
Inverting voltage	z10	−	Link <i>one</i> of b6/8/10 or z8 to bz4	P-B	
		+		P-A	
Differential voltage			−	One of b6/8/10 or z8	P-B
			+		P-A
	One of b6/8/10 or z8	+	z10	P-B	
		−		P-A	

# Installation Dimensions in mm (inches)

Plug-In Unit of 3U Height, to IEC 297

3rd angle  
projection



## Command Signal Generator Card

### EEA-DSG-450-A-10 Series

#### General Description

This card is used to generate input signals for open and closed loop electro-hydraulic control systems. In addition to internally applying the command signals which can be set on the card, it can be used for driving external command potentiometers; the internal potentiometers can then be used to limit the range of adjustment.

#### Features and Benefits

- The polarity of all five command signals can be changed using soldered links.
- The summing amplifier is provided with an additional input for cascading several cards.
- The amplifier has an inverting and a non-inverting output.
- The status of the relevant command signal is indicated on the front panel by LEDs.

#### Operating Data

Supply voltage .....  $\pm 15V \pm 5\%$ ,  
x 50 mA max.

Impedance of potentiometer P1 to P5 .....  $2 k\Omega$

No. of command signal relays ..... 5

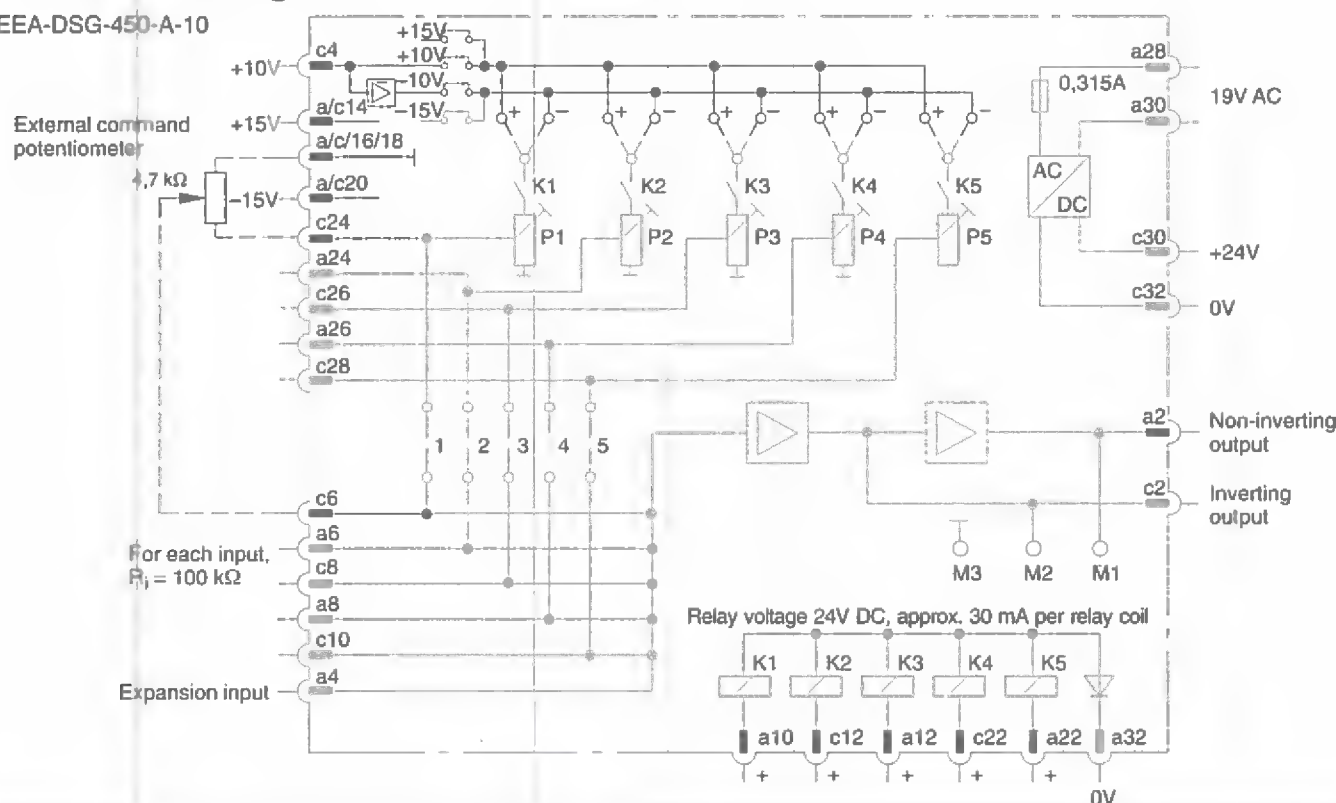
Relay voltage .....  $24V \pm 20\%$ ,  
approx. 30 mA per relay

Male connector ..... DIN 41612, D32

Mass ..... 0,15 kg (0.33 lb)

#### Connection Diagram

EEA-DSG-450-A-10



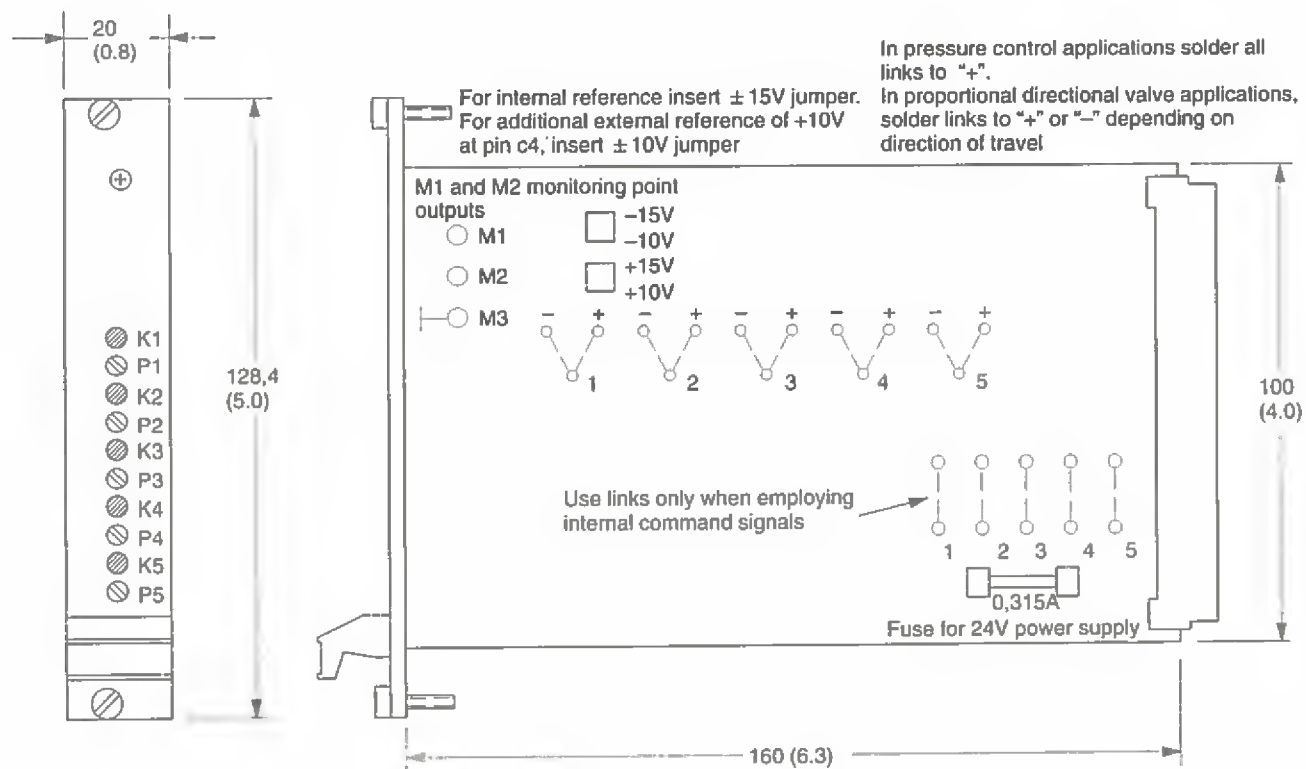
**Warning: Electromagnetic Compatibility (EMC)**

The European Community directives for electromagnetic compatibility (EMC) do not apply to this product.

GB-2094



# Installation Dimensions in mm (inches)



## OP AMP Amplifier Card

### EEA-AMP-451-A-10 Series

#### General Description

This card has been developed as a universal element for system construction. The large number of different OP AMP circuits, individual assignment to solder terminals and the possibility of external linking of the individual OP AMPs, make this card very versatile.

#### Features and Benefits

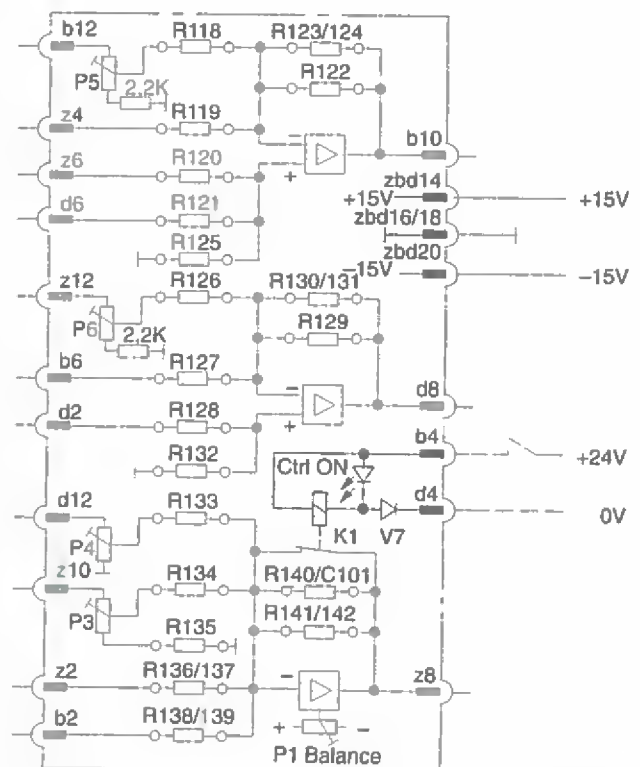
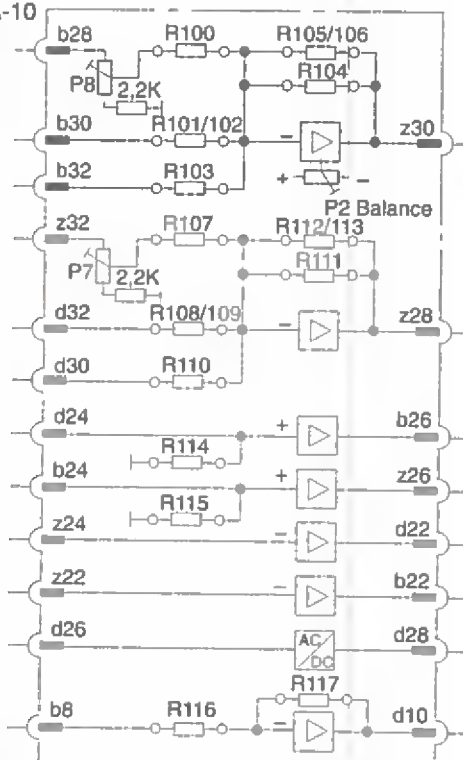
- 11 OP AMP circuits.
- Assignment to solder terminals, therefore highly flexible.
- External wiring of individual OP AMPs possible.
- 8 spindle-drive resistors on the front panel, for fine adjustment of the OP AMPs.
- 1 relay for enabling an amplifier.
- An LED on the front panel indicates the switching status.

#### Operating Data

Supply voltage	..... $\pm 15V \pm 5\%$ , x 50 mA max.
Relay voltage	..... $24V \pm 20\%$ , approx. 30 mA
Differential amplifiers	..... 2
Summing circuits	..... 2
P/I controllers	..... 1
Millivolt rectifiers	..... 1
Inverters	..... 3
Voltage followers	..... 2
Male connector	..... DIN 41612, F48
Mass	..... 0,14 kg (0.3 lb)

#### Connection Diagram

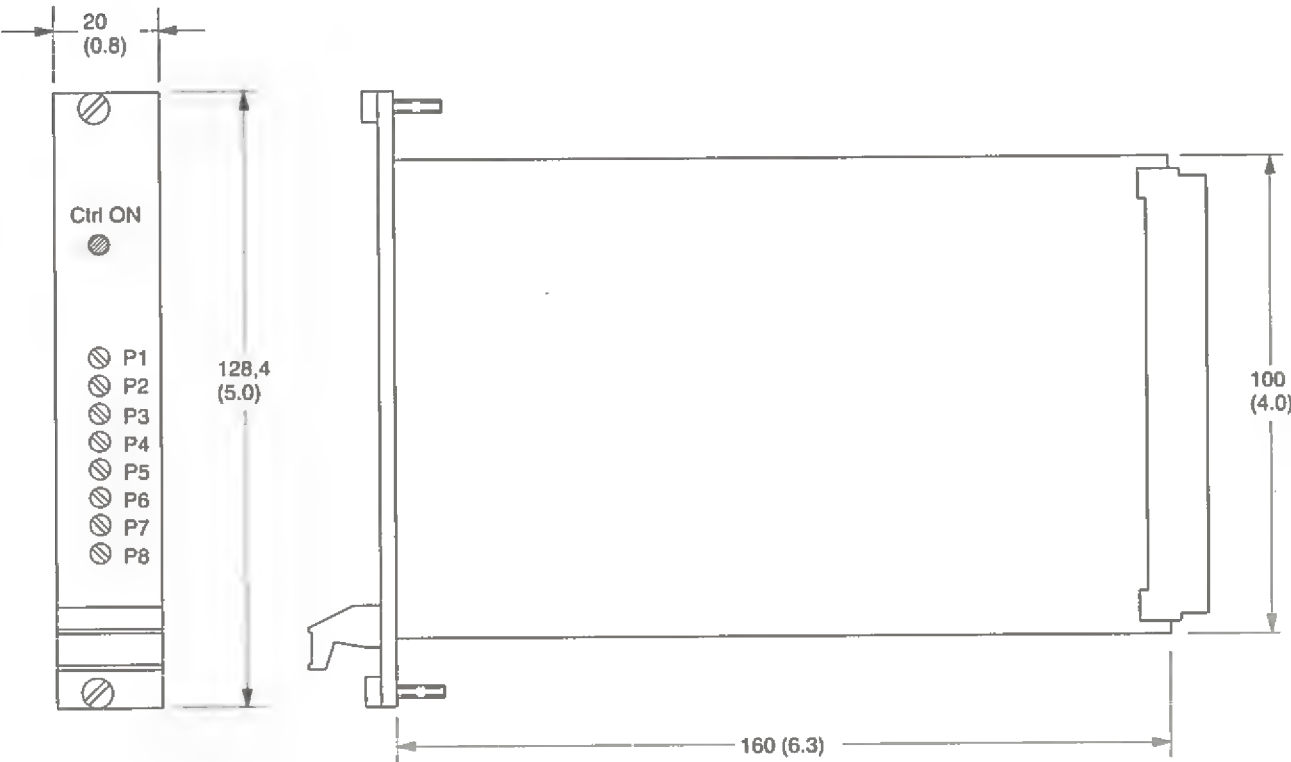
EEA-AMP-451-A-10



**Warning: Electromagnetic Compatibility (EMC)**

The European Community directives for electromagnetic compatibility (EMC) do not apply to this product.

Installation Dimensions in mm (inches)



## Relay Card

### EEA-REL-452-A-10 Series

#### General Description

This card allows logic links to be made between individual functional groups of a control system.

#### Features and Benefits

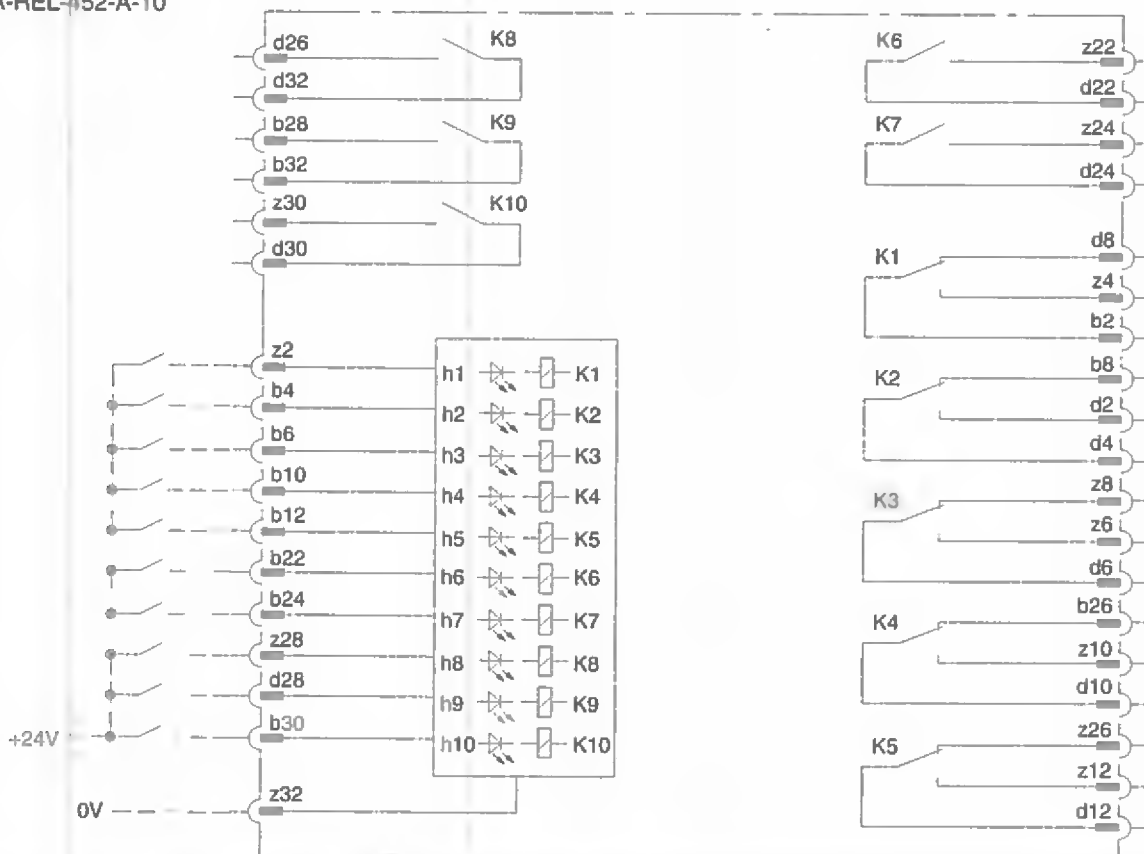
- 10 separate switchable relays.
- 5 normally-open contacts and 5 change-over contacts.
- Switching status of relays indicated by LEDs on the front panel.
- Encapsulated relays with gold-plated contacts for long life.

#### Operating Data

Relay voltage ..... 24V  $\pm$  20%,  
approx. 30 mA per relay,  
including LED  
Switched voltage ..... 60V DC max.  
Switched current ..... 1A max.  
Male connector ..... DIN 41612, F48  
Mass ..... 0,14 kg (0.3 lb)

#### Connection Diagram

EEA-REL-452-A-10



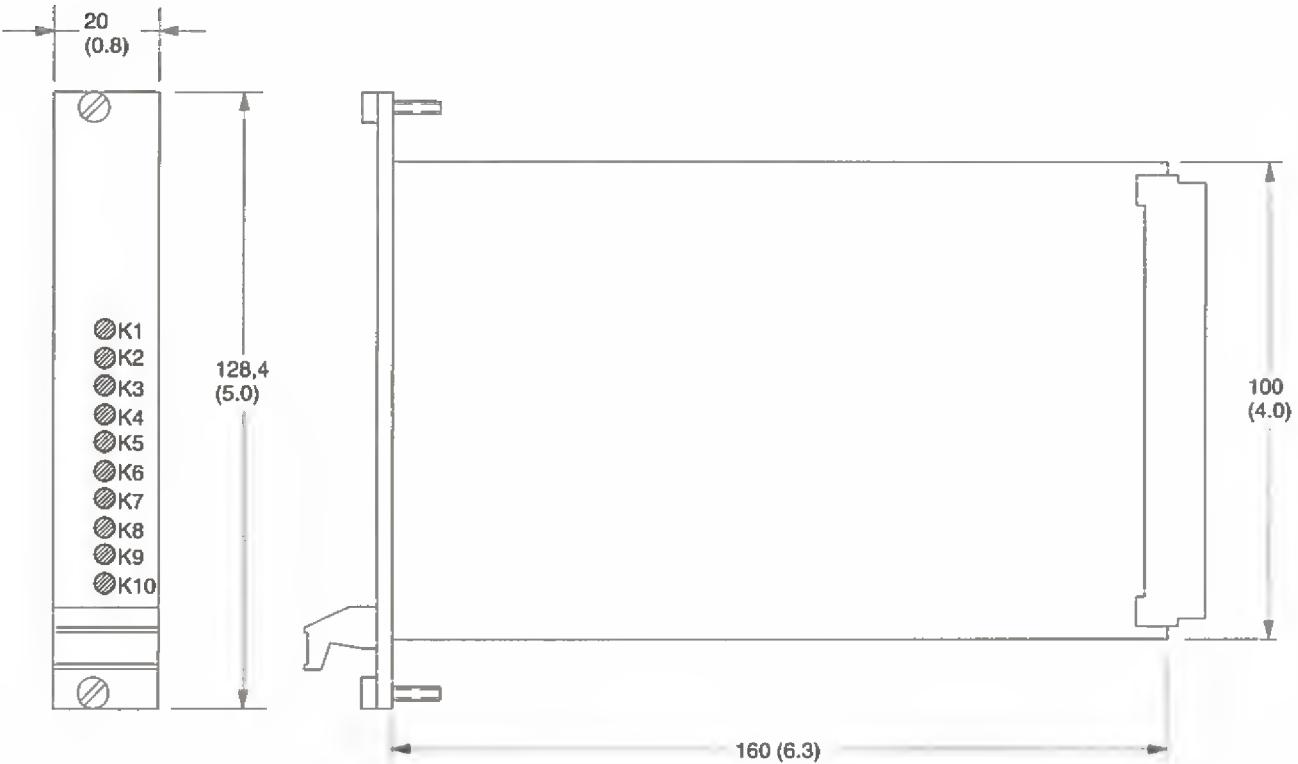
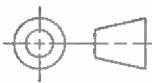
**Warning: Electromagnetic Compatibility (EMC)**

The European Community directives for electromagnetic compatibility (EMC) do not apply to this product.

GB-2096A

Installation Dimensions in mm (inches)

3rd angle  
projection



## Comparator Card

### EEA-LIM-454-A-10 Series

#### General Description

This card contains two limit comparators with one inverting and one non-inverting logic output, plus an output relay with a change-over contact.

#### Features and Benefits

- Individual input circuitry.
- Separately adjustable switching thresholds.
- Test points for positive and negative switching thresholds.
- Test points for input signals.
- Additionally usable OP AMP stages: 2 voltage followers and 1 inverter.
- Switching state indicated by LEDs on the front panel.
- Inverting, non-inverting and relay outputs with change-over contact.
- Selectable drive inhibitor.

#### Operating Data

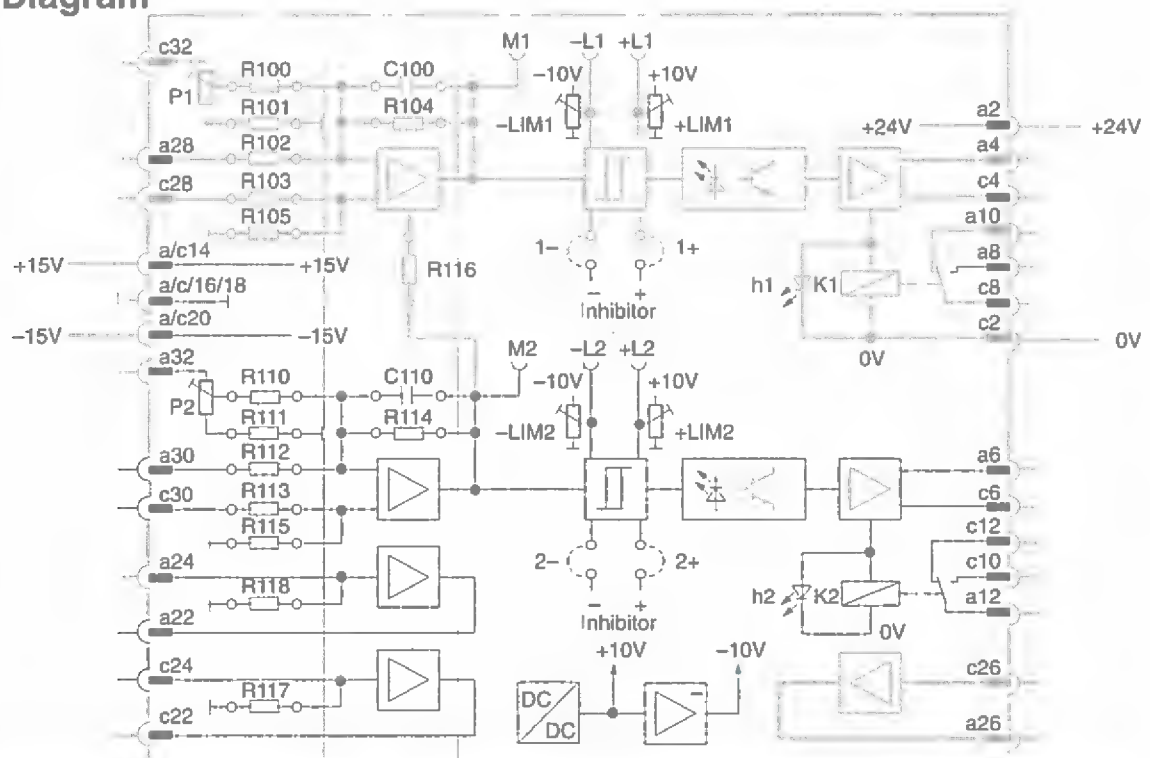
Supply voltage ..  $\pm 15V \pm 5\% \times 50 \text{ mA}$   
 Relay voltage or voltage for logic outputs ..... 24V DC  
 500 mA max.

Contact ratings  
 of relays ..... 60V DC max., 1A  
 8 test points .....  $\varnothing 2 \text{ mm}$   
 (0.0787" dia) sockets

Male connector ..... DIN 41612, D32  
 Mass ..... 0,13 kg (0.3 lb)

#### Connection Diagram

EEA-LIM-454-A-10

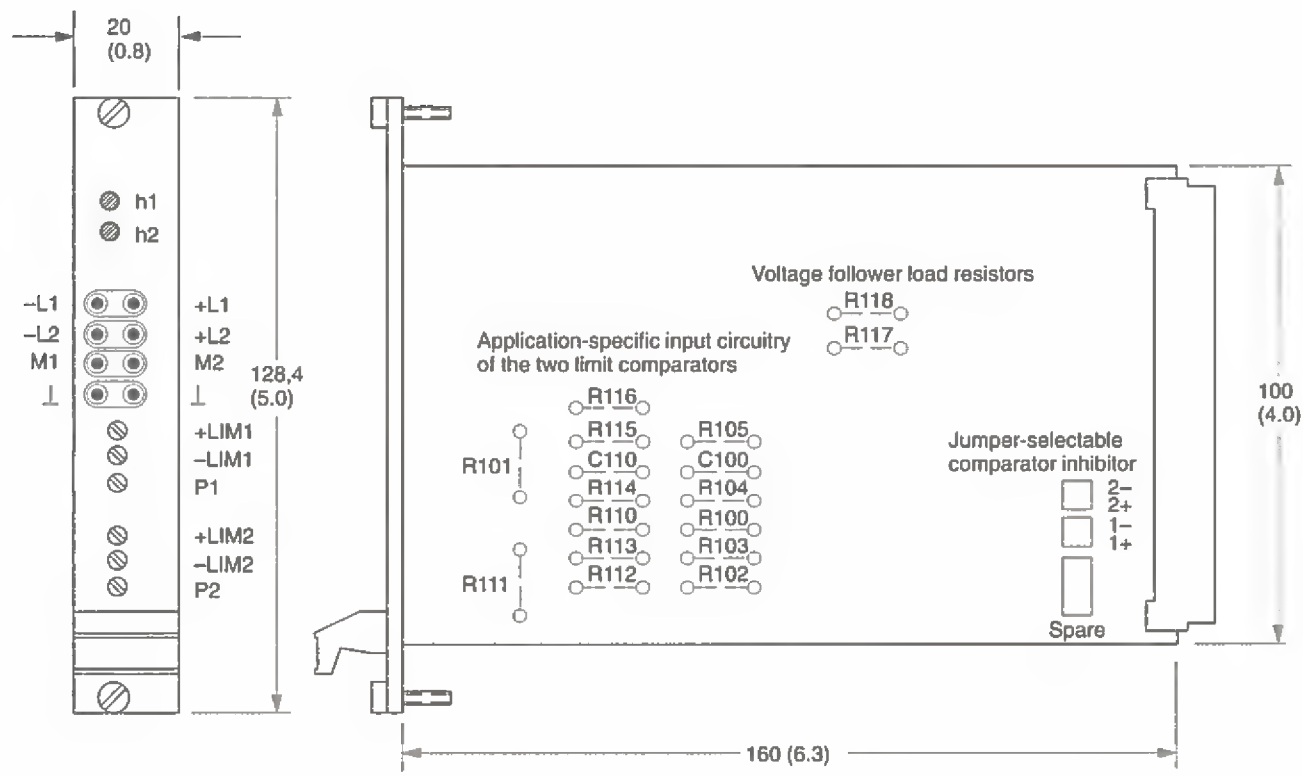


**Warning: Electromagnetic Compatibility (EMC)**

The European Community directives for electromagnetic compatibility (EMC) do not apply to this product.

GB-2098A

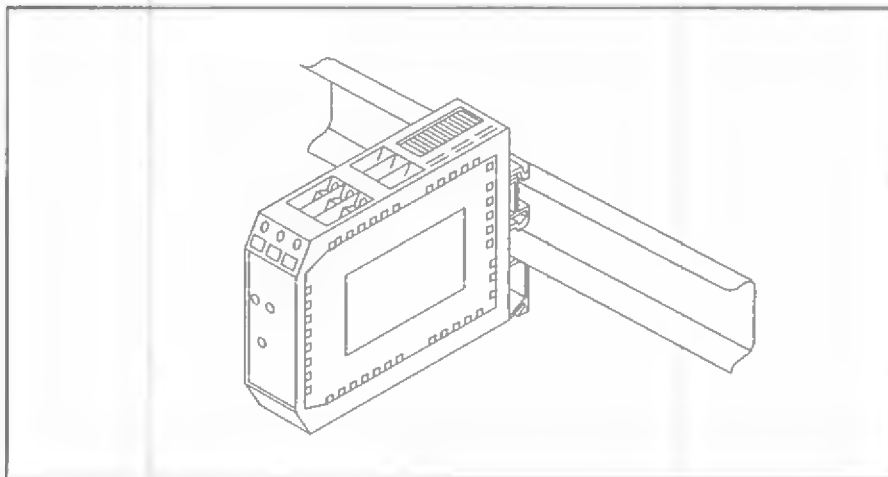
Installation Dimensions in mm (inches)





## Electronic Control Modules for DIN-Rail-Mounting

EHA-CON-201-A-20; EHA-RMP-201-A-20; EHA-PSU-201-A-10



### Features and Benefits

- Provides for enhancement of control system for Vickers "KA" and "KB" series integrated valve/amplifier proportional valves
- Snap-on to DIN EN 50022 or DIN EN 50035 rails
- 24V DC power supply with wide tolerance
- All output signals  $\pm 10V$  DC
- Screw terminals reduce wiring installation costs
- All of user adjustments clearly identified
- LEDs show status

### General Description

A range of three "Snap-on" control modules for mounting into control cabinets, using rails to DIN EN 50022 or DIN EN 50035. The range is ideally suited for use with Vickers "KA" and "KB" series of proportional valves with integrated drive electronics, where external ramp generation, conversion from current to voltage command signals, etc. may be required.

All adjustment potentiometers, together with status LEDs and switches are mounted on the front panels of the modules.


Supply voltage to all models is 24V DC. Wiring connections are via screw clamp terminals.

### General Specification

For data specific to each module see later "Operating Data" sections.

Power (input) supply	24V DC nom. See individual module data.
Control (output) supplies	See individual module data
Connections	Screw clamping terminals
Wiring recommendations, all connections	0,5 to 2,5 mm <sup>2</sup> (22 to 12 AWG)
Mounting	Rails to DIN EN 50022 or DIN EN 50035
Housing material	Polyamid 6.6
Protection	IEC 529 class IP20
Vibration: Vickers environmental specification	Class I level 2 (IEC 68-2-6)
Electromagnetic compatibility (EMC): Emission Immunity	EN 50081-2 EN 50082-2
Ambient temperature range: Operational Storage	0 to 50°C (+32 to 122°F) -25 to 85°C (-13 to +185°F)
Mass: EHA-CON-201-A-20 EHA-RMP-201-A-20 EHA-PSU-201-A-10	0,2 kg (0.45 lb) 0,2 kg (0.45 lb) 0,2 kg (0.45 lb)



This product has been designed and tested to meet specific standards outlined in the European Electromagnetic Compatibility Directive (EMC) 89/336/EEC, amended by 91/263/EEC, 92/31/EEC and 93/68/EEC, article 5. For instructions on installation requirements to achieve effective protection levels, see this leaflet and the Installation Wiring Practices for Vickers Electronic Products leaflet 2468. Wiring practices relevant to this Directive are indicated by  Electromagnetic Compatibility (EMC).

GB-2410B

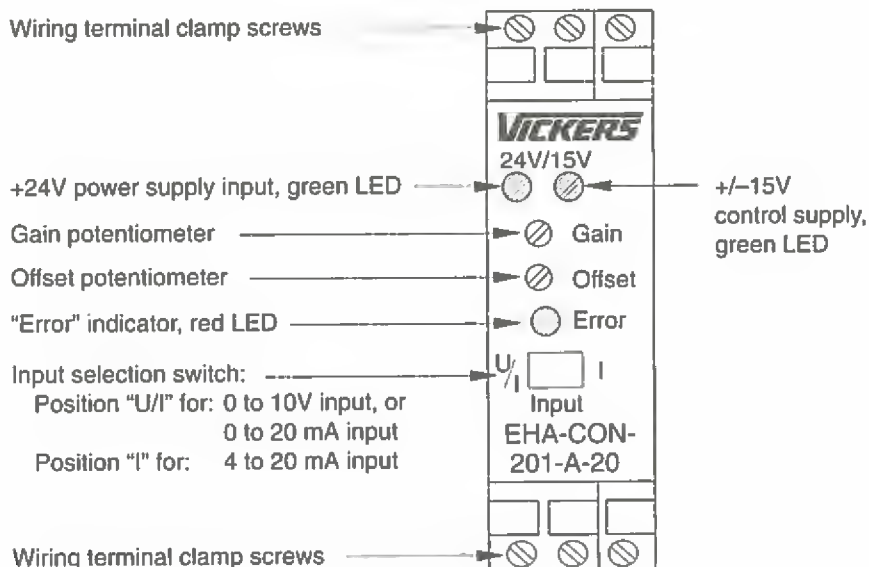
# Signal Converter Module

## EHA-CON-201-A-20

Converts uni-polar current and uni-polar voltage signals to bi-polar voltage output signal in the range  $\pm 10V$ , to match the requirements of Vickers "KA" and "KB" series valves.

The output is grounded if the input signals are out of their operating range. Simultaneously a red "error" LED is illuminated and an "error" switching signal provided. The system self-resets when the input comes within its operating range.

### Front Panel; Actual Size



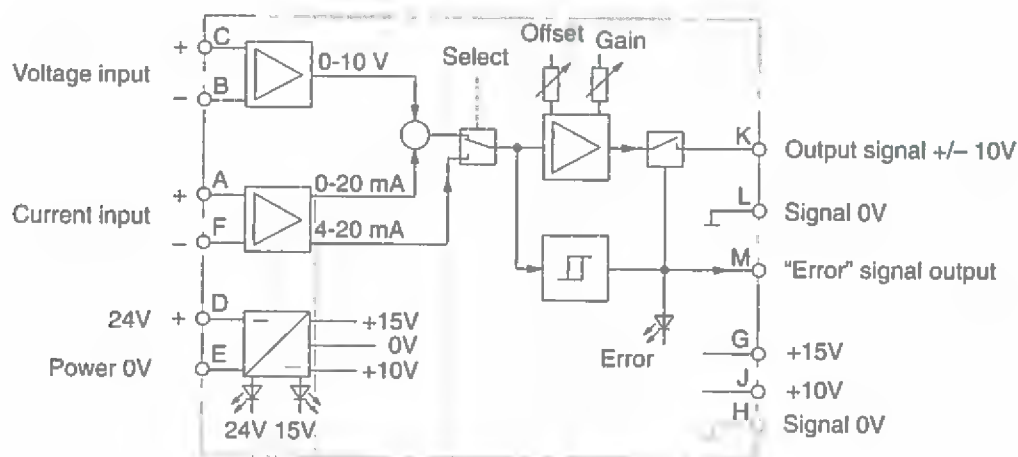
### Operating Data

Power (input) supply		24V DC nominal x 6W (18-36V DC including $\pm 10\%$ pk. to pk. ripple)
Control (output) supplies	[G] [J]	+15V x 50 mA +10V x 5 mA Temperature drift $< 1 \text{ mV}/^\circ\text{C}$ thru $0-50^\circ\text{C}$ ( $< 0.5 \text{ mV}/^\circ\text{F}$ thru $32-122^\circ\text{F}$ )
Output signal	[K]	$\pm 10V \times 5 \text{ mA max.}$ Temperature drift $< 1 \text{ mV}/^\circ\text{C}$ thru $0-50^\circ\text{C}$ ( $< 0.5 \text{ mV}/^\circ\text{F}$ thru $32-122^\circ\text{F}$ )
Gain adjustment		60 to 100% of max. output signal range
Zero point ("Offset") adjustment range		$\pm 1V$ at output
Input signal:		
Current	[A/F]	0 to 20 mA, with selector switch set to "U/I", or 4 to 20 mA, with selector switch set to "I"
Voltage	[C/B]	0 to 10V, with selector switch set to "U/I"
Input signal zero point		
0 to 20 mA input		10 mA
4 to 20 mA input		12 mA
0 to 10V input		5V
Input/output conversion:		
0 to 20 mA input		} $- 10V$ to $+10V$ output
4 to 20 mA input		
0 to 10V input		
Error switching output signal ▲	[M]	23V DC (typical) x 100 mA: short-circuit protected; with flywheel diode

▲ The input error indicates that the input signal is out of its operating range. The output self-resets if the signal is in the correct operating range.

# Signal Converter Module EHA-CON-201-A-20

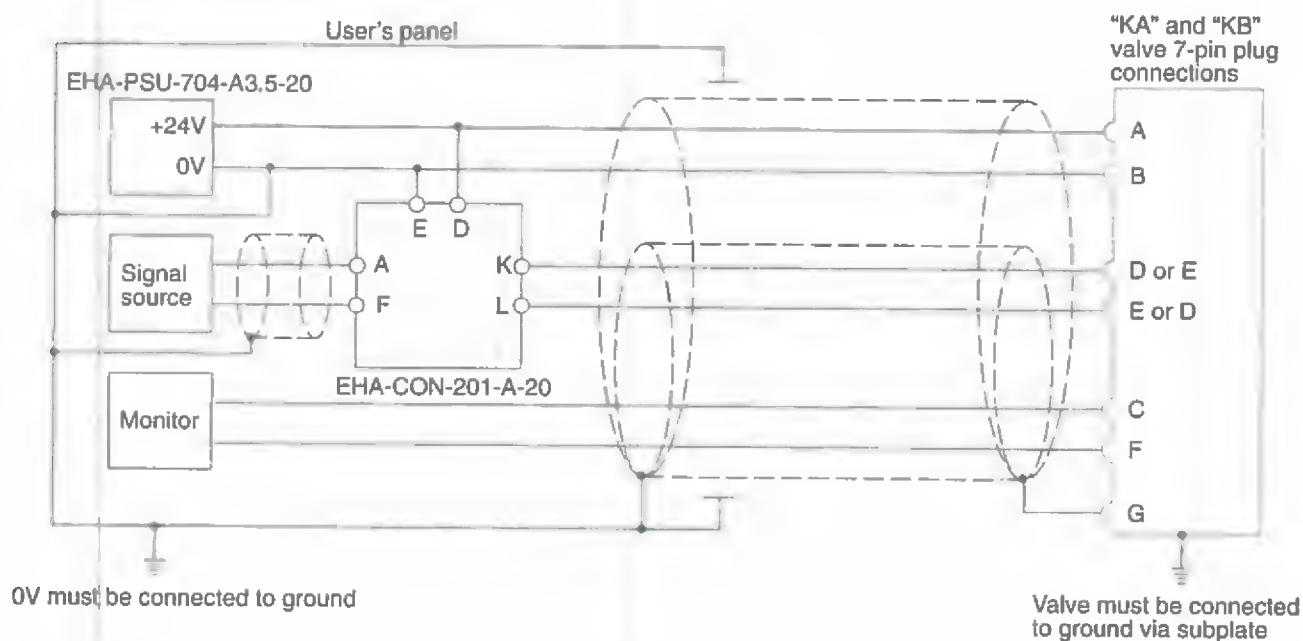
## Electrical Block Diagram



**Note:** The unused input signal pin B or C must be connected to signal 0V (pin H or pin L).

## Typical Connection Arrangement

Customer-generated current command signal used to control KA/BDG\*V-\* valve with integral amplifier



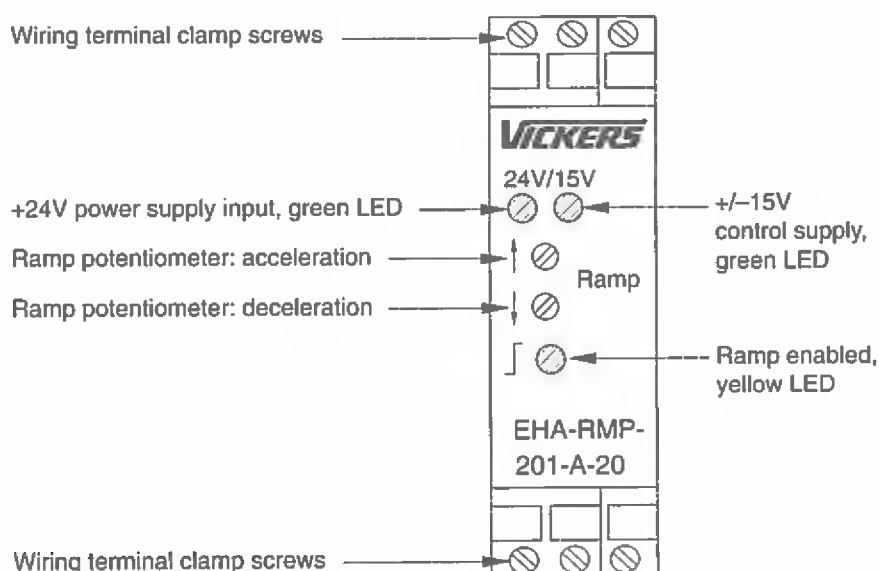
↓ Customer's protective ground connection.

# Ramp Generator Module EHA-RMP-201-A-20

Separately adjustable acceleration and deceleration can be applied to voltage signals in the range +10V to -10V. The ramp is enabled by an external 24V signal. When the ramp function is not enabled, the output and input signals are identical.

Control voltages are provided from a DC/DC converter.

## Front Panel; Actual Size

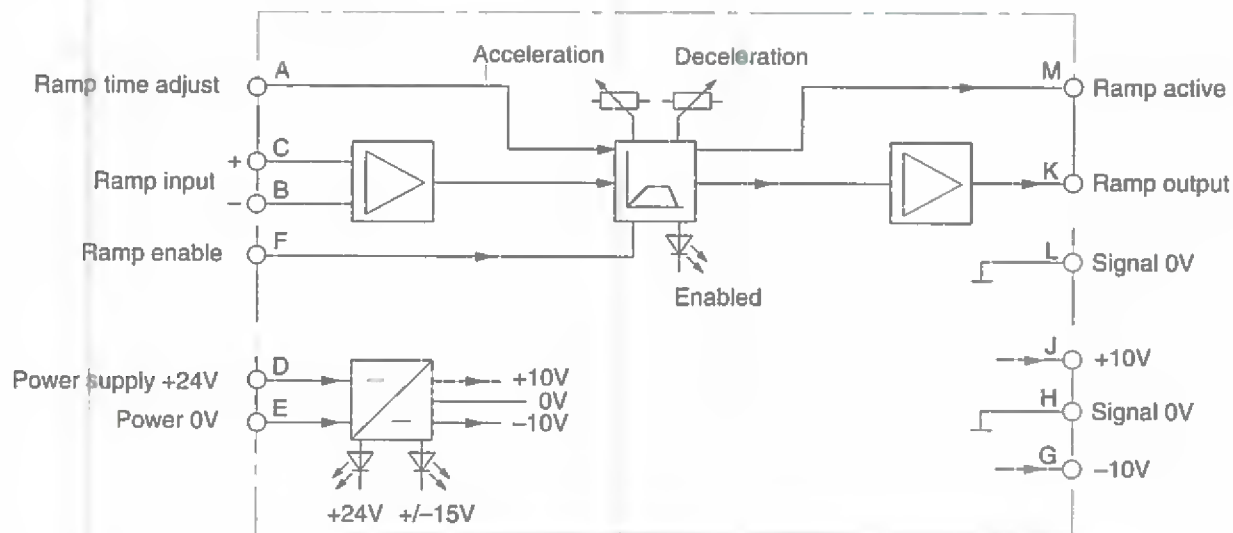


## Operating Data

Power (input) supply		24V DC nominal x 6W (18-36V DC including $\pm 10\%$ pk. to pk. ripple)
Control (output) supplies	[J] [G]	+10V x 10 mA -10V x 10 mA Temperature drift <1 mV/°C thru 0-50°C (<0.5 mV/°F thru 32-122°F)
Ramp differential input signal:		$\pm 10V$ , 100 k $\Omega$
Positive	[C]	
Negative	[B]	
Ramp output signal	[K]	$\pm 10V$ x 5 mA Temperature drift <1 mV/°C thru 0-50°C (<0.5 mV/°F thru 32-122°F)
Ramp function:		
Enable	[F]	12 to 40V ( $R_i = 2,7$ k $\Omega$ )
Disable	[F]	$\leq 3,5V$ or open circuit
Ramp adjustment:		
By potentiometer (separate acceleration and deceleration)		50 ms to 5s
By external voltage (common acceleration and deceleration with potentiometers at zero)	[A]	50 ms to 2s
Ramp active output signal	[M]	23V DC (typical) x 20 mA

# Ramp Generator Module EHA-RMP-201-A-20

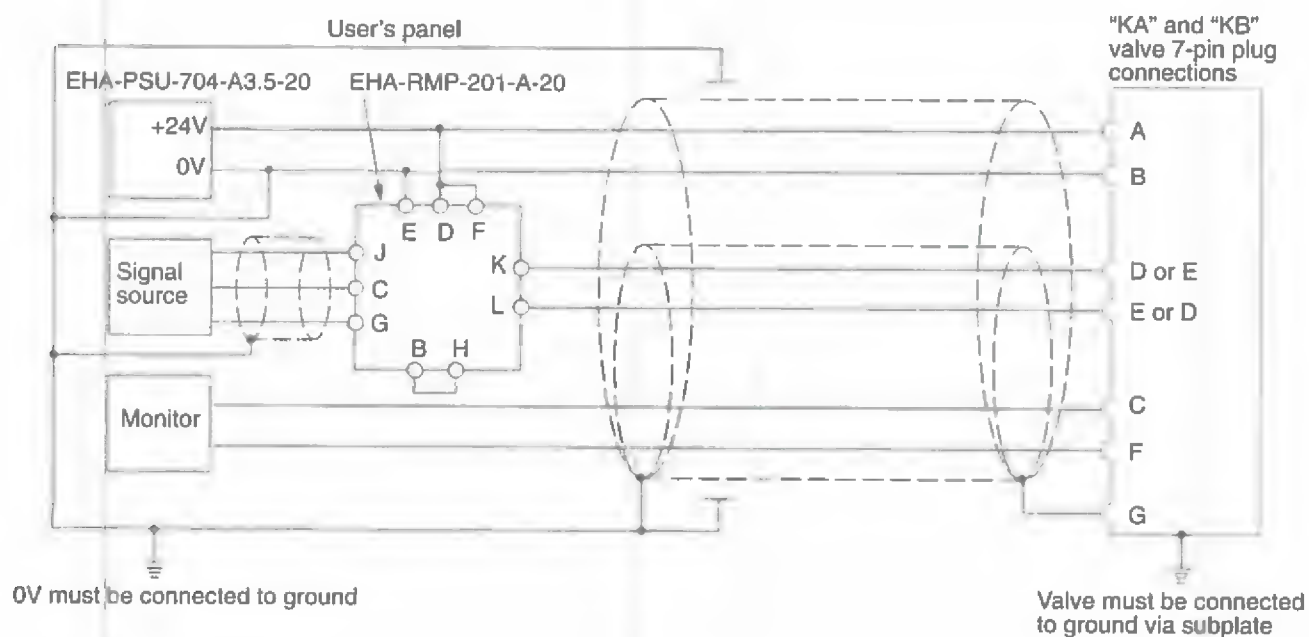
## Electrical Block Diagram



**Note:** The unused input signal pin B or C must be connected to signal 0V (pin H or pin L).

## Typical Connection Arrangement

Module limits acceleration and deceleration to preset levels



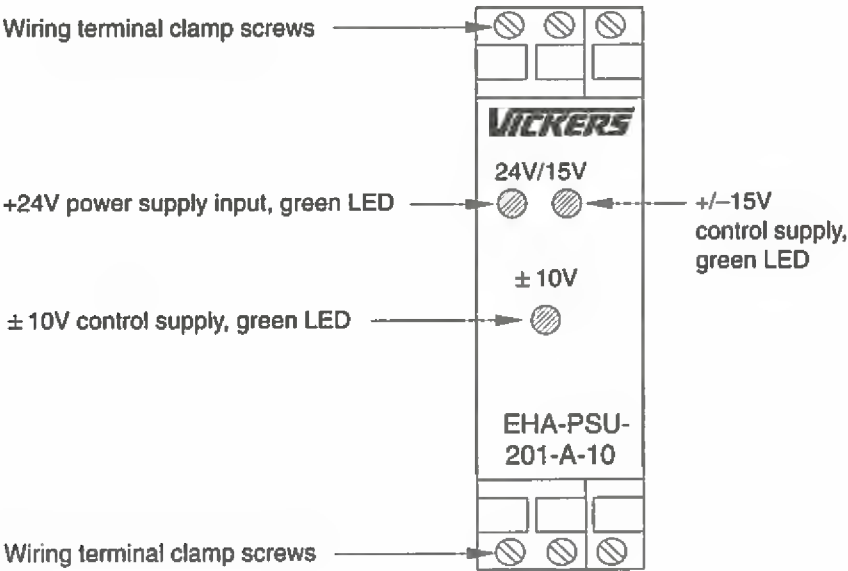
⏏ Customer's protective ground connection.

# Power Supply Module

## EHA-PSU-201-A-10

Provides control voltages of  $\pm 15\text{V}$  and  $\pm 10\text{V}$  when used with 24V power supply EHA-PSU-704-A-20

### Front Panel; Actual Size

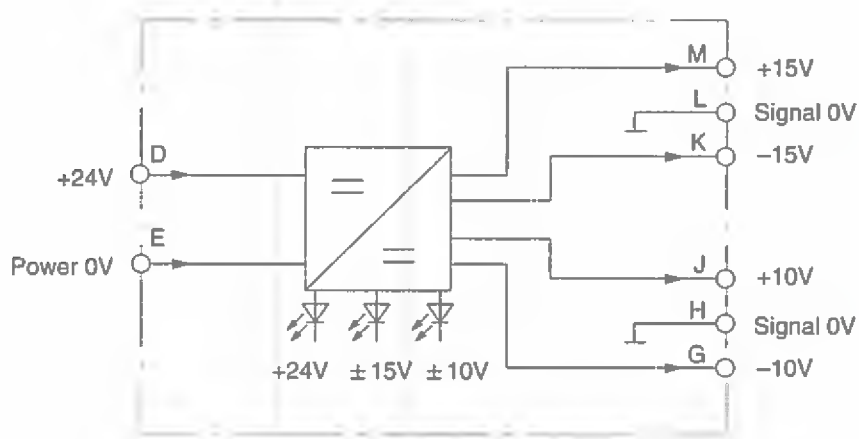


### Operating Data

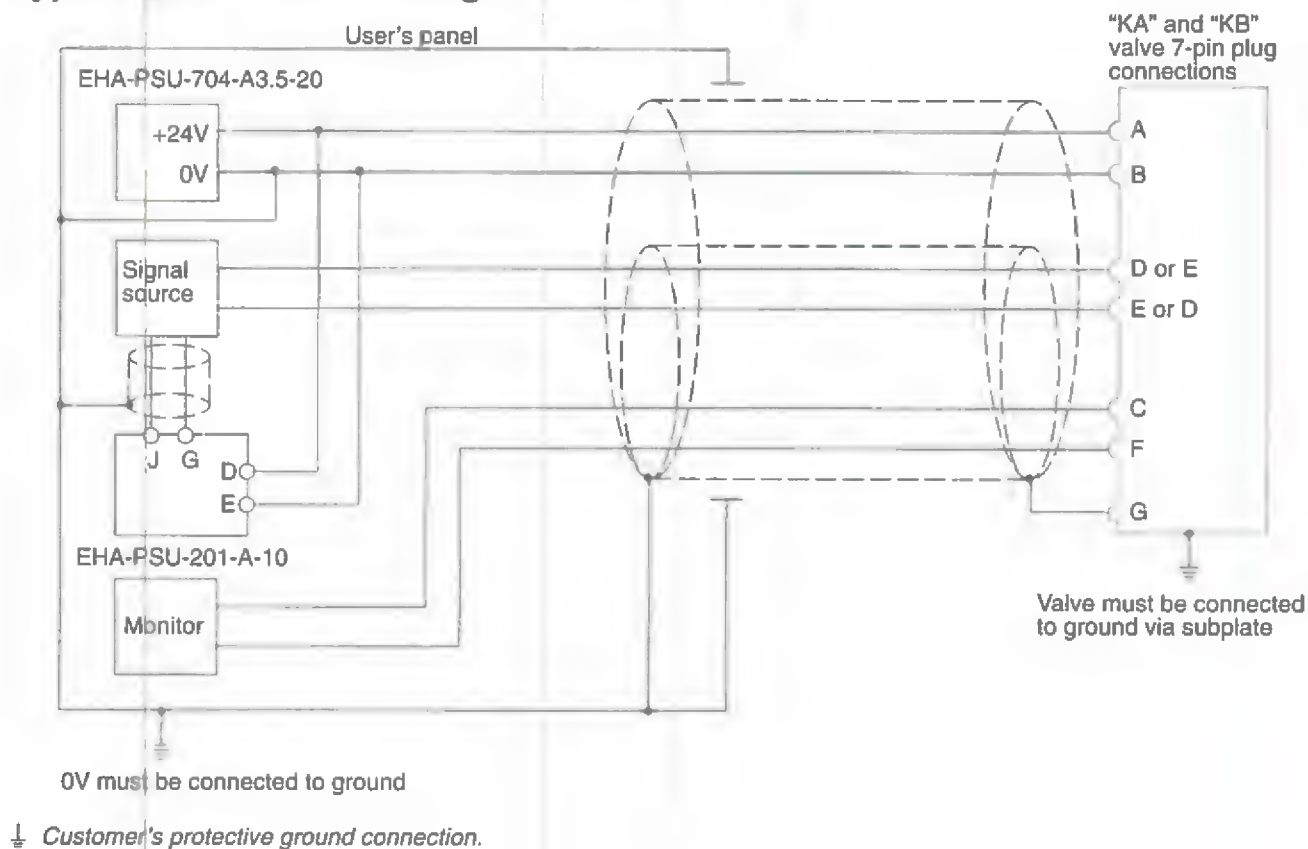
Power (input) supply		24V DC nominal x 12W (20-36V DC including $\pm 10\%$ pk. to pk. ripple)
Control (output) supplies	[M]	+15V x 250 mA
	[K]	-15V x 250 mA
	[J]	+10V x 50 mA
	[G]	-10V x 50 mA
		Temperature drift < 1 mV/ $^{\circ}\text{C}$ thru 0-50 $^{\circ}\text{C}$ (< 0.5 mV/ $^{\circ}\text{F}$ thru 32-122 $^{\circ}\text{F}$ )

# Power Supply Module EHA-PSU-201-A-10

## Electrical Block Diagram

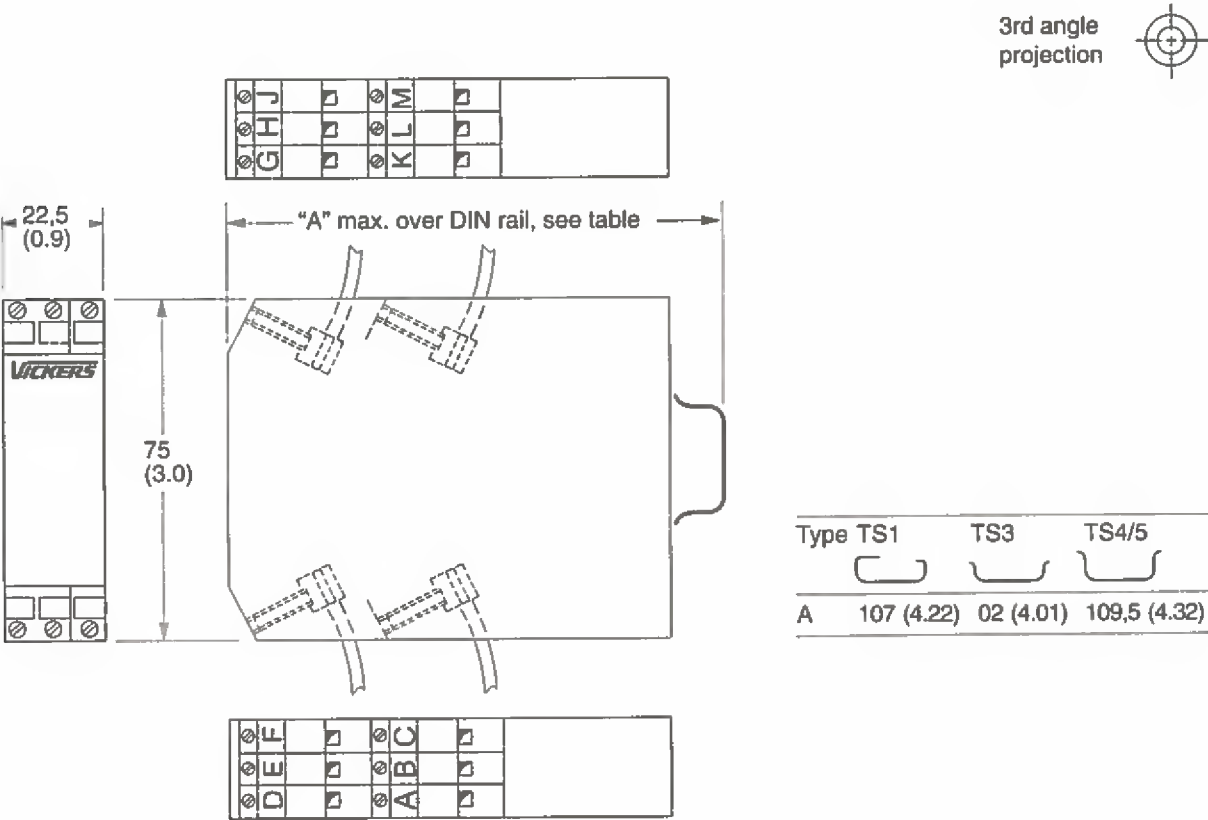


## Typical Connection Arrangement





# Installation Dimensions in mm (inches)



**Warning: Electromagnetic Compatibility (EMC)**

It is necessary to ensure that the unit is wired up in accordance with the connection arrangements shown in this leaflet. For effective protection the user's electrical cabinet, the valve subplate or manifold and the cable screens should be connected to efficient ground points. The metal 7 pin connector part no. 934939 should be used for the integral amplifier.

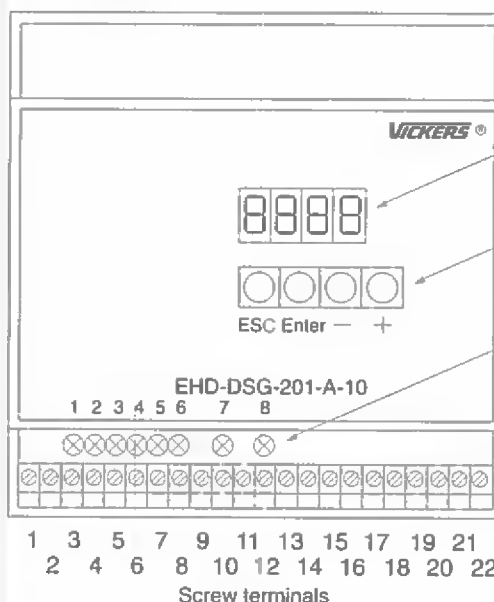
In all cases both valve and cable should be kept as far away as possible from any sources of electromagnetic radiation such as cables carrying heavy current, relays and certain kinds of portable radio transmitters, etc. Difficult environments could mean that extra screening may be necessary to avoid the interference.

## Demand Signal Generator Module for DIN Rail Mounting

EHD-DSG-201-A-10



### Front Panel



Display

Keys

LEDs:

1. Module enable
2. Setpoint enable
3. Setpoint 1 / Bit 0
4. Setpoint 2 / Bit 1
5. Setpoint 3 / Bit 2
6. Setpoint 4 / Bit 3
7. "OK" output
8. Not used

### General Description

This unit is one of a range of "snap-on" control modules designed for cabinet mounting on rails to DIN EN 50022 or DIN EN 50035. The range is ideally suited for use in control systems using Vickers "KA" or "KV" series proportional valves with integral amplifiers or Vickers "UNIPLUG" series, where external signal, deadband compensation and ramp generation may be required.

The Demand Signal Generator module has a built-in microprocessor which controls all of the facilities offered by the unit. Setting up the various control parameters is done via four input keys


mounted on the front panel. All settings are stored in an on-board EEPROM and once entered are retained, until reset, even when the power is switched off. Visual indication of all settings is provided by four 7-segment LED displays mounted on the front panel.

Up to 16 separate setpoints can be externally selected using four input connections in binary code. Setpoints 1 and 2 are scalable using 0-10 volt analog inputs. Unit operating status is indicated by seven separate LEDs. The unit also accepts a  $\pm 10$  volt feedback signal which is compared internally to the command signal and an "in range" signal is generated when they coincide.

### Features and Benefits

- Snap-on mounting to DIN rails
- 24V DC power supply with wide tolerance
- Standard  $\pm 10$ V DC output signal
- Screw terminals simplify installation
- 16 selectable output levels
- Keypad on front panel
- 4 x 7-segment LED display
- 4-quadrant ramps
- Ramp times up to 99.99 seconds
- Can replace previous design



This product has been designed and tested to meet specific standards outlined in the European Electromagnetic Compatibility Directive (EMC) 89/336/EEC, amended by 91/263/EEC, 92/31/EEC and 93/68/EEC, article 5. For instructions on installation requirements to achieve effective protection levels, see this leaflet and the Installation Wiring Practices for Vickers Electronic Products leaflet 2468. Wiring practices relevant to this Directive are indicated by  Electromagnetic Compatibility (EMC)

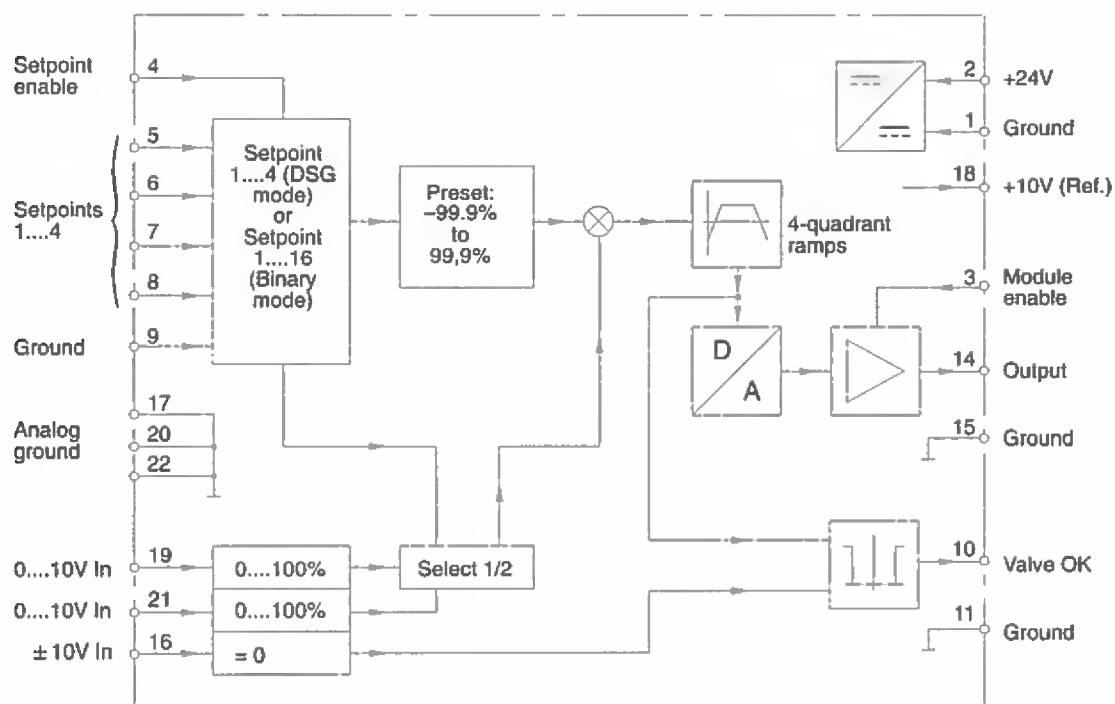
GB-2470

## Operating Data

Power supply:		
Power supply (input)	[2]	24V DC nominal x 6W
Range		18-36V DC (including $\pm 10\%$ pk-to-pk ripple)
Power ground	[1]	
Control supply (output)	[18]	+10V DC x 10 mA
		Temperature drift $< 1 \text{ mV}/^{\circ}\text{C}$ thru $0-50^{\circ}\text{C}$ ( $< 0.5 \text{ mV}/^{\circ}\text{F}$ thru $32-122^{\circ}\text{F}$ )
Switched input signals (monitored by green LEDs):		
Enable module	[3]	
Setpoint enable	[4]	
Setpoint 1/Bit 0	[5]	
Setpoint 2/Bit 1	[6]	} 16 possible setpoints in binary mode (4 in DSG mode) Range of outputs $-99,99$ to $+99,99\%$
Setpoint 3/Bit 2	[7]	
Setpoint 4/Bit 3	[8]	
Enable voltage		17 to 40V
Disable voltage		0 to 3,5V
Input impedance		2,7 k $\Omega$
Analog input signals:		
Control voltage for setpoint 1	[19]	0 to +10V
Ground	[20]	
Control voltage for setpoint 2	[21]	0 to +10V
Ground	[22]	
Feedback voltage from valve	[16]	$\pm 10\text{V}$
Input impedance		1 M $\Omega$
Switched output:		
Valve OK signal	[10]	Valve is following input signal correctly (Valve output polarity = command polarity or Valve within set deadband = command at null)
Valve has reached setpoint		V supply $-2\text{V}$
Valve has not reached setpoint		$< 3\text{V}$
Ground	[11]	
Not used	[12]	
Ground	[13]	
Maximum load current (short circuit protected)		$< 100 \text{ mA}$
Analog output:		
Drive voltage to valve	[14]	$\pm 10\text{V} \times 5 \text{ mA}$
Ground	[15]	Temperature drift $< 1 \text{ mV}/^{\circ}\text{C}$ thru $0-50^{\circ}\text{C}$ ( $< 0.5 \text{ mV}/^{\circ}\text{F}$ thru $32-122^{\circ}\text{F}$ )
Set-up adjustments (using four keys and 7-segment display on front panel):		
Setpoints		$-99,9$ to $+99,9 \%$ (represents $-10\text{V}$ to $+10\text{V}$ output voltage)
4-quadrant ramps		10 ms to 99,99s
2 deadbands		0 to 100%
Operating modes:		
16 binary inputs for normal operation		BIN
4 inputs simulating previous design		DSG
Setpoint 1 scalable		ON/OFF
Setpoint 2 scalable		ON/OFF
Ramp enable		ON/OFF
Module enable		ON/OFF
Feedback		ON/OFF

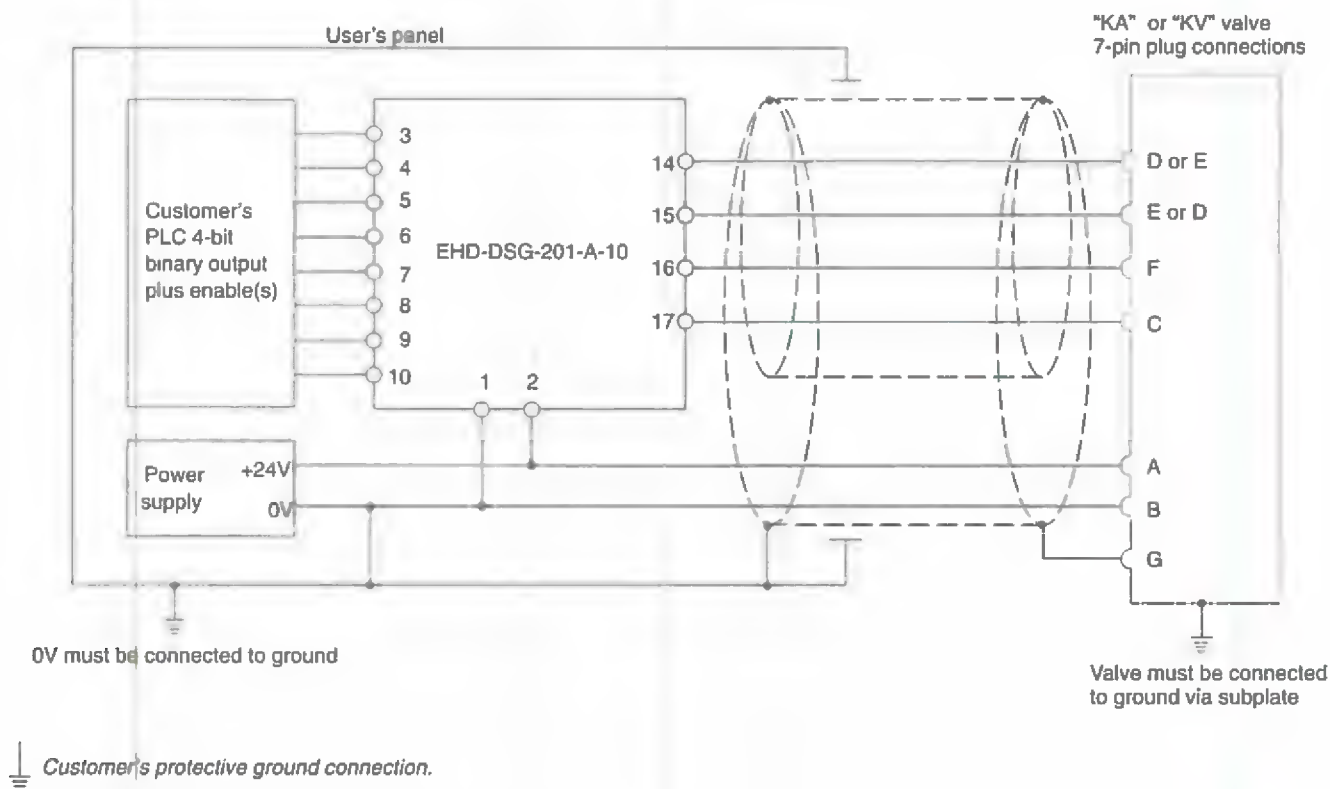
Displayed parameters:	
Power supply voltage	[2] V
Output voltage	[14] V
Control voltage for setpoint 1	[19] %
Control voltage for setpoint 2	[21] %
Number of active setpoint	1-16
Setpoint value	%
Feedback voltage	[16] %
Positive deadband	%
Negative deadband	%
Ramp times (4)	Seconds
Connections	Screw clamping terminals
Wiring recommendations, all connections	0,5 to 2,5 mm <sup>2</sup> (22 to 12 AWG)
Protection class	IEC 529 IP 20
Vibration:	
Vickers environmental specification (Class 1 level 2)	IEC 68-2-6
Electromagnetic compatibility (EMC):	
Emission	EN-50081-2
Immunity	EN-50082-2
Ambient temperature ranges:	
Operating	0°C to 50°C (32°F to 122°F)
Storage	-25°C to 85°C (-13°F to 180°F)
Mounting	Rails to DIN EN 50022 or DIN EN 50035
Housing material	Polyamid 6.6
Mass	0,3 kg (0.45 lb)

## Electrical Block Diagram



## Typical Connection Arrangement

Customer-generated logic signals select demand levels for valve with integral amplifier



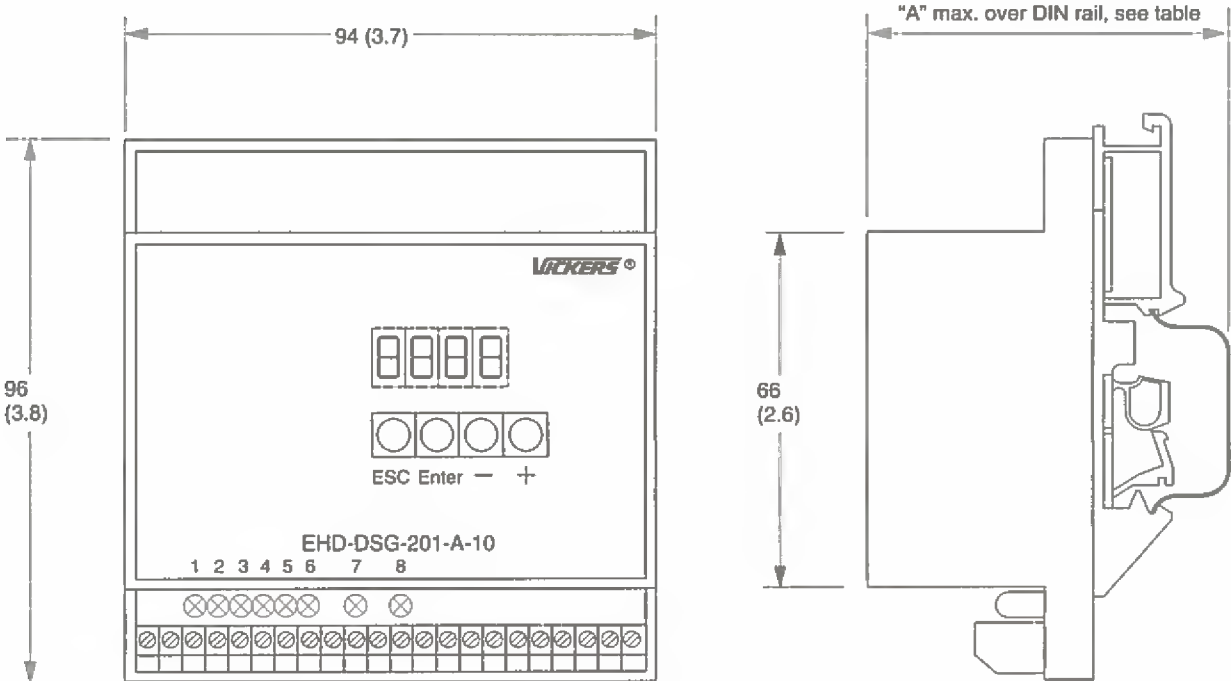
### **Warning: Electromagnetic Compatibility (EMC)**

It is necessary to ensure that the unit is wired up in accordance with the Typical Connection Arrangement shown in this leaflet. For effective protection, the user's electrical cabinet, the valve subplate or manifold and the cable screens should be connected to efficient ground points. The metal 7-pin connector part no. 934939 should be used for the integral amplifier.

In all cases, both valve and cable should be kept as far away as possible from any source of electromagnetic radiation such as cables carrying heavy current, relays and certain kinds of portable radio transmitters, etc. Difficult environments could mean that extra screening may be necessary to avoid the interference.

# Installation Dimensions in mm (inches)

3rd angle projection



Type	TS1	TS3	TS4/5
A	64,5 (2.6)	60,0 (2.4)	67,5 (2.7)



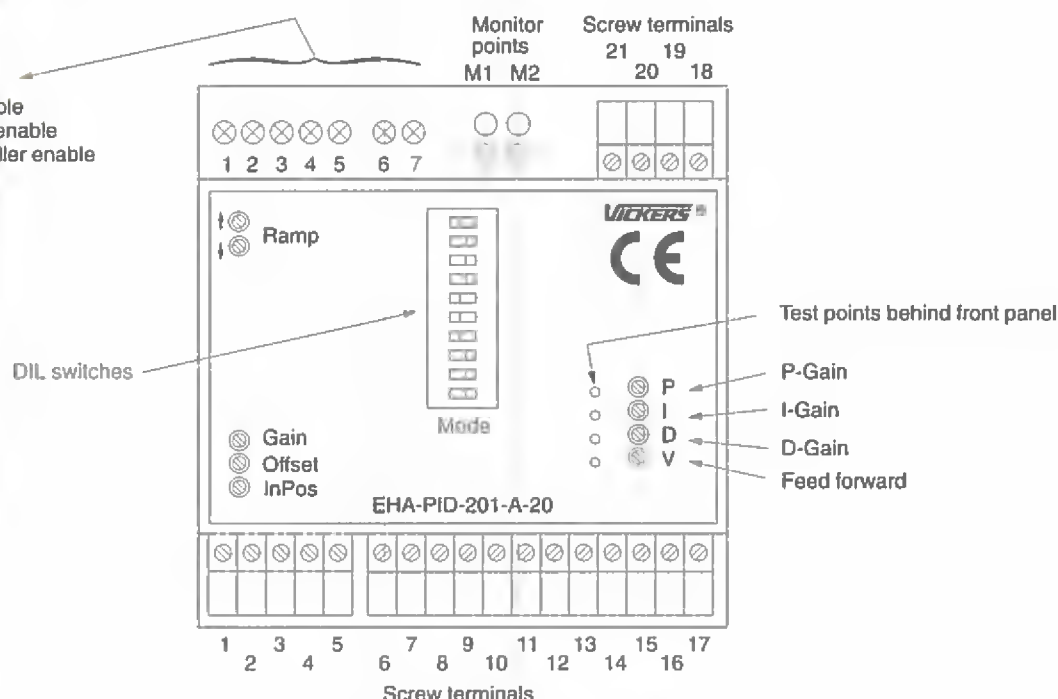
## Electronic PID Controller Module for DIN-Rail-Mounting

EHA-PID-201-A-20

### Front View

#### LEDs:

1. 24V
2.  $\pm 15V$
3. Ramp enable
4. Integrator enable
5. PID controller enable
6. Cable OK
7. In-Position



### General Description

This product is one of a range of "Snap-on" control modules for mounting into control cabinets, using rails to DIN EN 50022 or DIN EN 50035. The module is ideally suited for use with Vickers "KA" series of proportional valves with integrated drive electronics, where external PID functions may be required.

All adjustment potentiometers, together with status LEDs and switches are accessible from the front of the module.

### Features and Benefits

- Provides for enhancement of control system for Vickers "KA" series integrated valve/amplifier proportional valves
- Snap-on to DIN EN 50022 or DIN EN 50035 rails
- 24V DC power supply with wide tolerance
- Output signal  $\pm 10V$  DC
- Screw terminals reduce wiring installation costs
- All of user adjustments clearly identified
- LEDs show status
- Suitable for closed-loop pressure, closed-loop velocity, closed-loop position and p/Q controls. Integral selector switches are used to set the internal configuration of the controller
- Parameters P, I and D of the controller, ramp up and ramp down are independently adjustable
- Output is enabled by an external 24V signal
- Bi-polar reference voltages are available for external use



This product has been designed and tested to meet specific standards outlined in the European Electromagnetic Compatibility Directive (EMC) 89/336/EEC, amended by 91/263/EEC, 92/31/EEC and 93/68/EEC, article 5. For instructions on installation requirements to achieve effective protection levels, see this leaflet and the Installation Wiring Practices for Vickers Electronic Products leaflet 2468. Wiring practices relevant to this Directive are indicated by Electromagnetic Compatibility (EMC).

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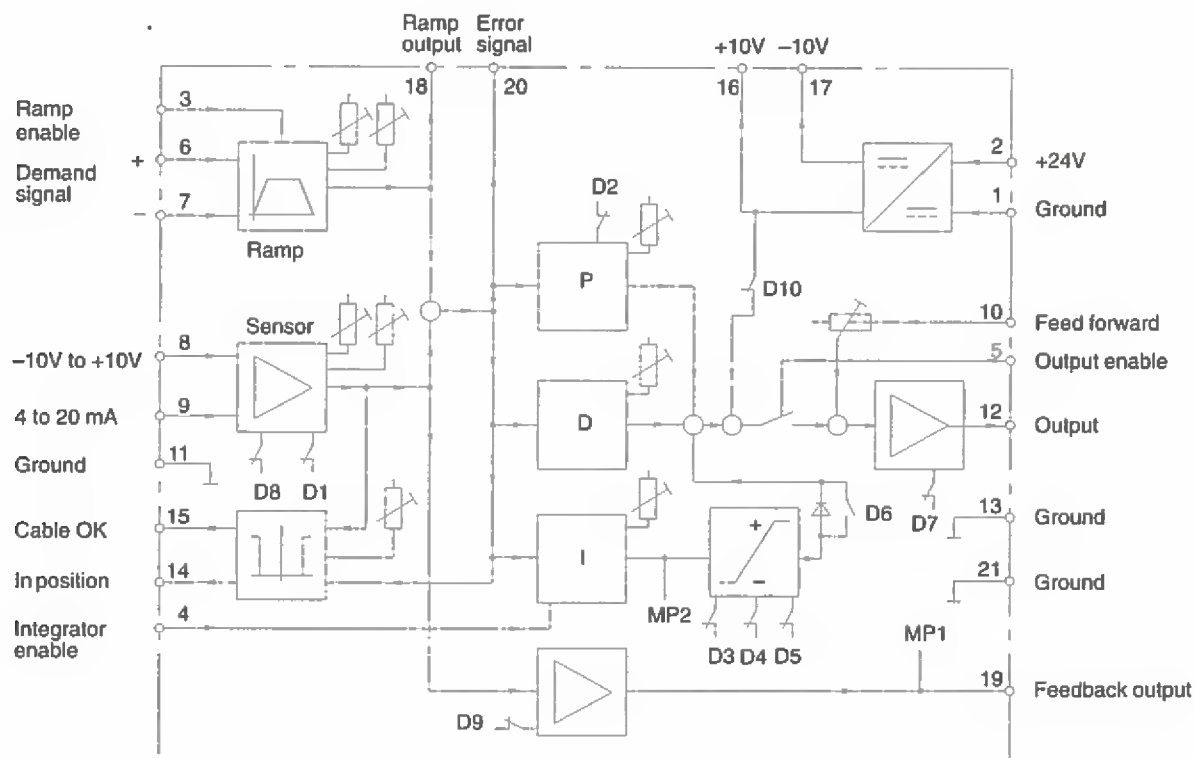
## Operating Data

Power (input) supply:		
Nominal	[2]	24V DC nominal x 6W
Range		18 to 36V DC including $\pm 10\%$ pk. to pk. ripple
Power ground	[1]	
Control (output) supplies	[16] [17]	+10V x 10 mA -10V x 10 mA Temperature drift: < 1 mV/°C thru 0-50°C (< 0.5 mV/°F thru 32-122°F)
Differential demand input signal:		$\pm 10V$ ; 100 k $\Omega$
Positive	[6]	
Negative	[7]	
Sensor inputs:		
Voltage input	[8]	$\pm 10V$ ; 1 M $\Omega$
Current input	[9]	0 to 20 mA or 4 to 20 mA; 100 $\Omega$
Ground	[11]	
Feed forward input	[10]	$\pm 10V$ ; 6 k $\Omega$
Monitoring of sensor failure for sensors with a current output only (4 to 20 mA)		
Switched inputs:		
Ramp enable	[3]	
Integrator enable	[4]	
PID controller enable	[5]	
Enabled		17 to 40V
Disabled		0 to 3,5V
Input impedance		10 k $\Omega$
Switched outputs:		
Sensor and cable OK	[15]	$V_{Supply}-2V$ < 3V < 100 mA
Sensor or cable failure		
Load current (continuous short circuit proof)		
This output may be used only in conjunction with sensors providing a current output (4 to 20 mA)		
In position	[14]	$V_{Supply}-2V$ < 3V < 100 mA
Sensor matches demand		
Sensor does not match demand		
Load current (continuous short circuit proof)		
The load at terminal [14] and [15] has to be connected to ground		
Analog outputs:		
PID controller output	[12]	
Sensor (feedback) signal	[19]	
Ramp output signal	[18]	
Range		$\pm 10V$ x 5 mA Temperature drift: < 1 mV/°C thru 0-50°C (< 0.5 mV/°F thru 32-122°F)
Error signal (inverted) (indicates the difference between demand signal and sensor signal)	[20]	$\pm 10V$ x 1 mA

Continued on next page

<b>Potentiometers:</b> P-gain (depends on DIL-switch D2) I-gain (depends on DIL-switches D3 to D5) D-gain Feed forward Ramp adjustment, separate acceleration and deceleration Sensor gain Sensor offset In-position window		0,1 to 50 V/V 0,5 to 100 V/S/V 0 to 0,05 V/V/S 20% to 100%  50 ms to 5s 0,9 to 1,3 -10V to +10V ± 0,1V to ± 1V
<b>Monitor point signals:</b> Sensor (feedback) signal Integrator output Monitor point impedance	[M1] [M2]	± 10V ± 10V 10 kΩ
<b>Connections</b>		Screw clamping terminals
<b>Wiring recommendations, all connections</b>		0,5 to 2,5 mm <sup>2</sup> (AWG 12)
<b>Protection class</b>		IEC 529 IP 20
<b>Vibration:</b> Vickers environmental specification Class 1 level 2		IEC 68-2-6
<b>Electromagnetic compatibility (EMC):</b> Emission Immunity		EN-50081-2 EN-50082-2
<b>Ambient temperature ranges:</b> Operating Storage		0°C to 50°C (32°F to 122°F) -25°C to 85°C (-13°F to 180°F)
<b>Mounting</b>		Rails to DIN EN 50022 or DIN EN 50035
<b>Housing material</b>		Polyamid 6.6
<b>Mass</b>		0,3 kg (0.45 lb)

## Electrical Block Diagram



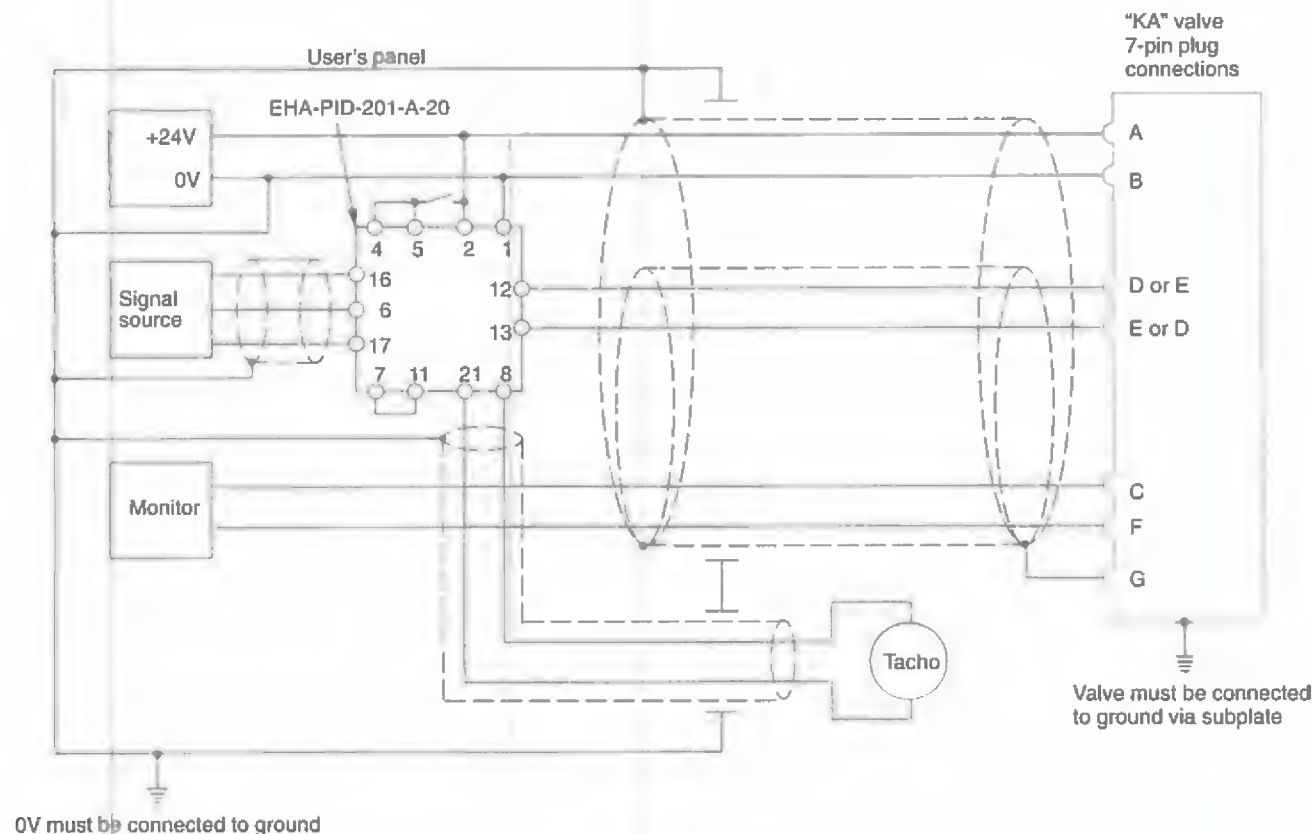
Note: The unused input signal pin 6 or 7 must be connected to signal 0V (pin 11, 13 or 21).



**Warning:** In a power-up sequence, the integrator should not be enabled until all hydraulic, electrical and control power and signals are applied and stable. Abrupt or unpredictable motion may occur if the integrator is enabled during this transition time.

# Typical Connection Arrangement

Simple closed-loop velocity feedback control



Customer's protective ground connection.



## Warning: Electromagnetic Compatibility (EMC)

It is necessary to ensure that the unit is wired up in accordance with the Typical Connection Arrangement shown in this leaflet. For effective protection, the user's electrical cabinet, the valve subplate or manifold and the cable screens should be connected to efficient ground points. The metal 7-pin connector part no. 934939 should be used for the integral amplifier.

In all cases, both valve and cable should be kept as far away as possible from any source of electromagnetic radiation such as cables carrying heavy current, relays and certain kinds of portable radio transmitters, etc. Difficult environments could mean that extra screening may be necessary to avoid the interference.

## Set-up Notes

### DIL-Switches

Switch	ON	OFF
D1	For sensors with 4 to 20 mA output	For sensors with 0 to 20 mA or $\pm 10V$ output
D2	P-gain 2 to 50 (default)	P-gain 0,1 to 2
D6	One-sided limitation of the integrator output (Only useful for proportional pressure and proportional throttle valves)	No limitations of integrator output
D7	Controller output signal not inverted	Controller output signal inverted
D8	For sensors with 4 to 20 mA output	For sensors with 0 to 20 mA or $\pm 10V$ output
D9	Sensor output signal not inverted	Invert the sensor (feedback) output signal
D10	For PQ control with internal switchover	For simple closed loop systems without switchover

The switches D3, D4 and D5 work together. They limit the I-gain between 5% and 100% as follows.

D3	D4	D5	I-Gain
ON	ON	ON	100% (default)
ON	ON	OFF	50%
ON	OFF	ON	35%
ON	OFF	OFF	25%
OFF	ON	ON	5.9%
OFF	ON	OFF	5.8%
OFF	OFF	ON	5.3%
OFF	OFF	OFF	5.0%

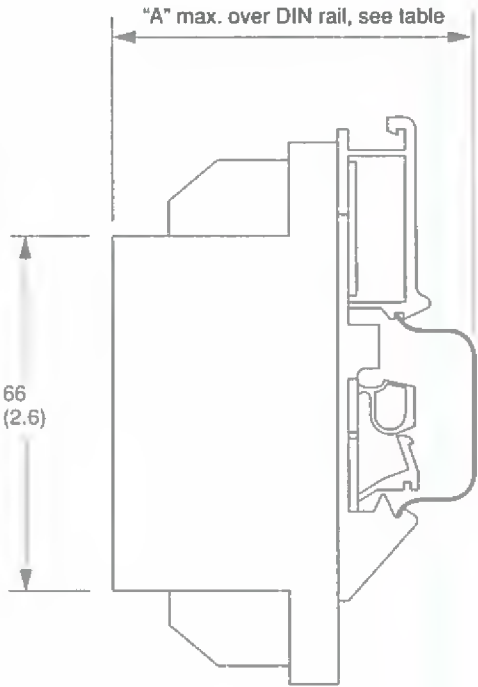
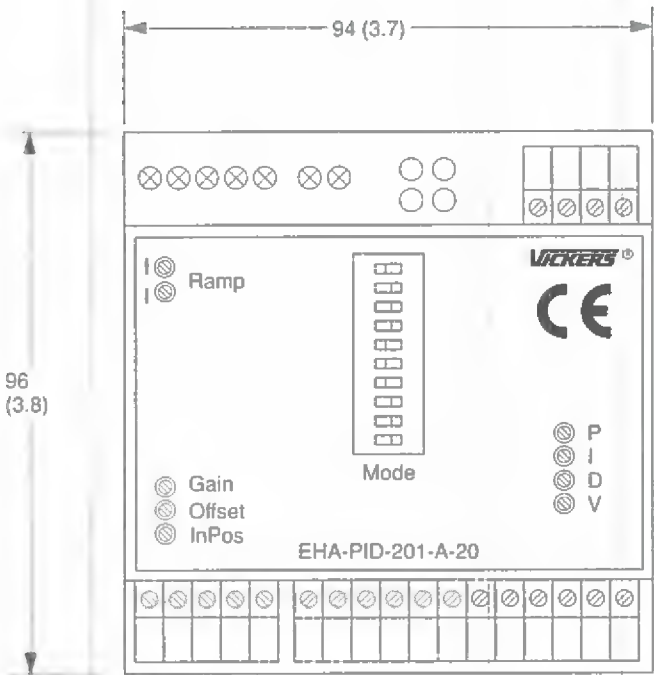
### Reconfiguration of Controller

#### Parameters

Once the controller parameters have been optimized and set, they can be measured by means of an ohmmeter. This allows easy configuration of the controller on different cards for use as spare parts or on standard machine series.

Four test points are located on the PID module for this purpose. The resistance between the appropriate test point (V, P, I and D), as shown in "Front View" on page C.110, and ground (at terminal [1], [11], [13] or [21]) determines the controller parameters.

Installation Dimensions in mm (inches)

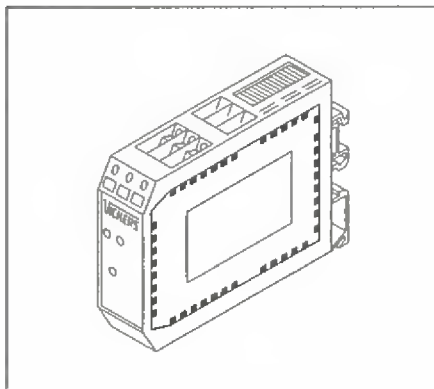


Type	TS1	TS3	TS4/5
A	64,5 (2.6)	60,0 (2.4)	67,5 (2.7)



## Power Amplifier for Servo Valves

EHA-PAM-291-A-20



Front Panel; Actual Size

### General Description

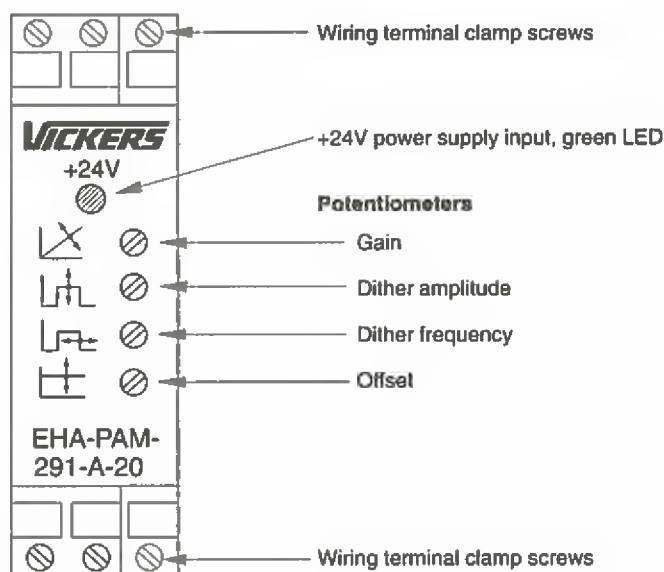
The EHA-PAM-291-A-20 power amplifier is designed for controlling Vickers SM4 servo-valves, or other servo-valves up to 200 mA max. current.


Gain, offset and dither (frequency and amplitude) are adjustable by potentiometers mounted in the front panel. An externally switched, 24V "drive enable" signal is used to switch the power drive on and off.

The amplifier is packaged as a "snap-on" control module for mounting into control cabinets using mounting rails to DIN EN 50022 or DIN EN 50035.

### Features and Benefits

- LED shows when 24V power supply is present
- Two test terminals allow dither amplitude and gain setting (output current) to be measured, simplifying start-up and fault finding
- Output stage is short circuit protected
- "Drive enable/disable" controlled by external signal
- Uni-polar voltage input; bi-polar current output



This product has been designed and tested to meet specific standards outlined in the European Electromagnetic Compatibility Directive (EMC) 89/336/EEC, amended by 91/263/EEC, 92/31/EEC and 93/68/EEC, article 5. For instructions on installation requirements to achieve effective protection levels, see this leaflet and the Installation Wiring Practices for Vickers Electronic Products leaflet 2468. Wiring practices relevant to this Directive are indicated by  Electromagnetic Compatibility (EMC).

## Operating Data

Power supply	24V DC nominal (18 to 36V DC), 7W max. Ripple pk-to-pk $\leq 4V_{pp}$
Differential input signal	0 to $\pm 10V$ ( $R_i = 47\text{ k}\Omega$ ) (overload capacity up to max. $\pm 25V$ )
Maximum output current	$\pm 200\text{ mA}$ ( $\pm 350\text{ mA}$ at min. supply voltage)
Gain:	
Adjustment range	1 to 40 mA/V
Factory setting	4 mA/V
Offset:	
Adjustment range	+ 40 to - 40 mA output current
Factory setting	0 mA
Drive enable	12 to 36V ( $R_i = 4,7\text{ k}\Omega$ )
Drive disable	< 8V, or open circuit
Dither amplitude:	
Adjustment range	0 to 20%
Factory setting	4%
Dither frequency:	
Adjustment range	150 to 500 Hz
Factory setting	400 Hz
Linearity	< 0,5%
Temperature coefficient	< 0,05% per $^{\circ}\text{C}$ (0.03% per $^{\circ}\text{F}$ )
-3 dB frequency response	> 1,5 kHz
Test terminals (E and F measured against D):	
E: output current	1V = 500 mA
F: dither	1V = 2,5% amplitude
Wiring recommendations, all connections	0,5 to 2,5 mm <sup>2</sup> (22 to 12 AWG)
Housing material	Polyamid 6.6
Protection	IEC 529 class IP20
Vibration:	
Vickers environmental specification	Class I level 2 (IEC 68-2-6)
Electromagnetic compatibility (EMC):	
Emission	IEC 529 class IP20
Immunity	EN 50081-2 EN 50082-2
Ambient temperature range:	
Operational	0 $^{\circ}$ to +50 $^{\circ}\text{C}$ (+32 $^{\circ}$ to +122 $^{\circ}\text{F}$ )
Storage	-25 $^{\circ}$ to +85 $^{\circ}\text{C}$ (-13 $^{\circ}$ to +185 $^{\circ}\text{F}$ )
Mass	0,11 kg (0.24 lb)

## Adjustments

### Gain

Output current/input voltage ratio is increased by turning the potentiometer clockwise; decreased by turning counter-clockwise.

### Dither Amplitude

The dither amplitude is measured as a percentage of the maximum value. Increase by turning the potentiometer clockwise; decrease by turning counter-clockwise.

### Dither Frequency

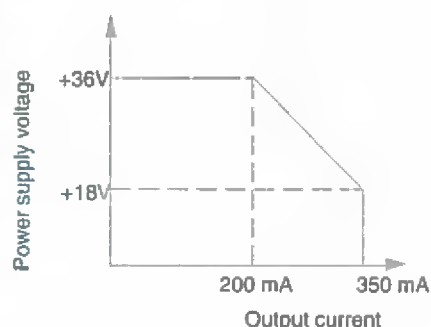
Increase by turning the potentiometer clockwise; decrease by turning counter-clockwise.

### Offset

Turn the potentiometer clockwise to obtain a negative offset of output current; counter-clockwise for a positive offset.

## Operating Range

If the required output current is above 200 mA and the load resistance is below 50  $\Omega$ , the power supply voltage must be reduced in accordance with characteristics shown.

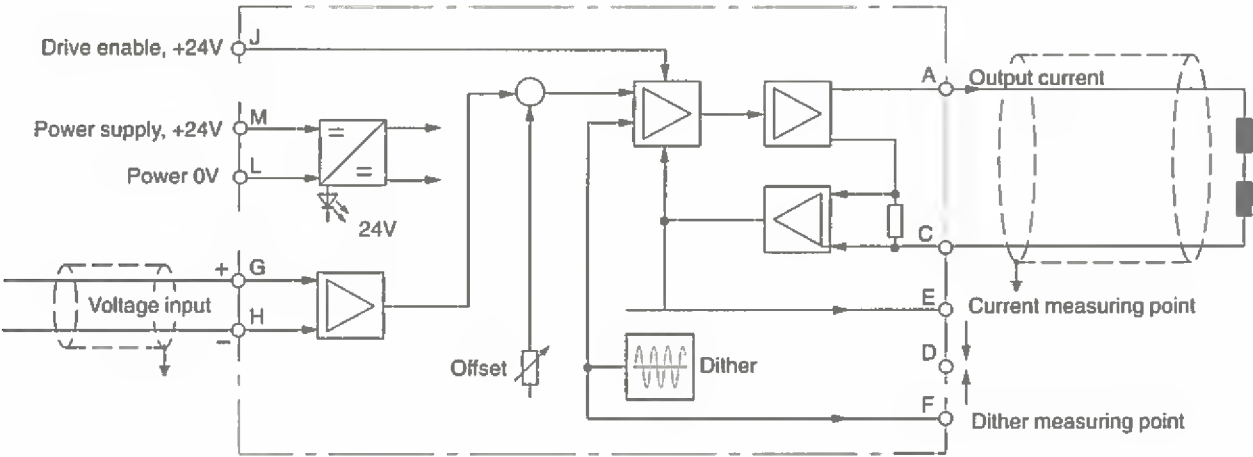


### Warning: Electromagnetic Compatibility (EMC)

It is necessary to ensure that the unit is wired up in accordance with the connection arrangements shown in this leaflet. For effective protection, the user's electrical cabinet, the valve subplate or manifold and the cable screens should be connected to efficient ground points. The metal 7-pin connector part no. 934939 should be used for the integral amplifier.

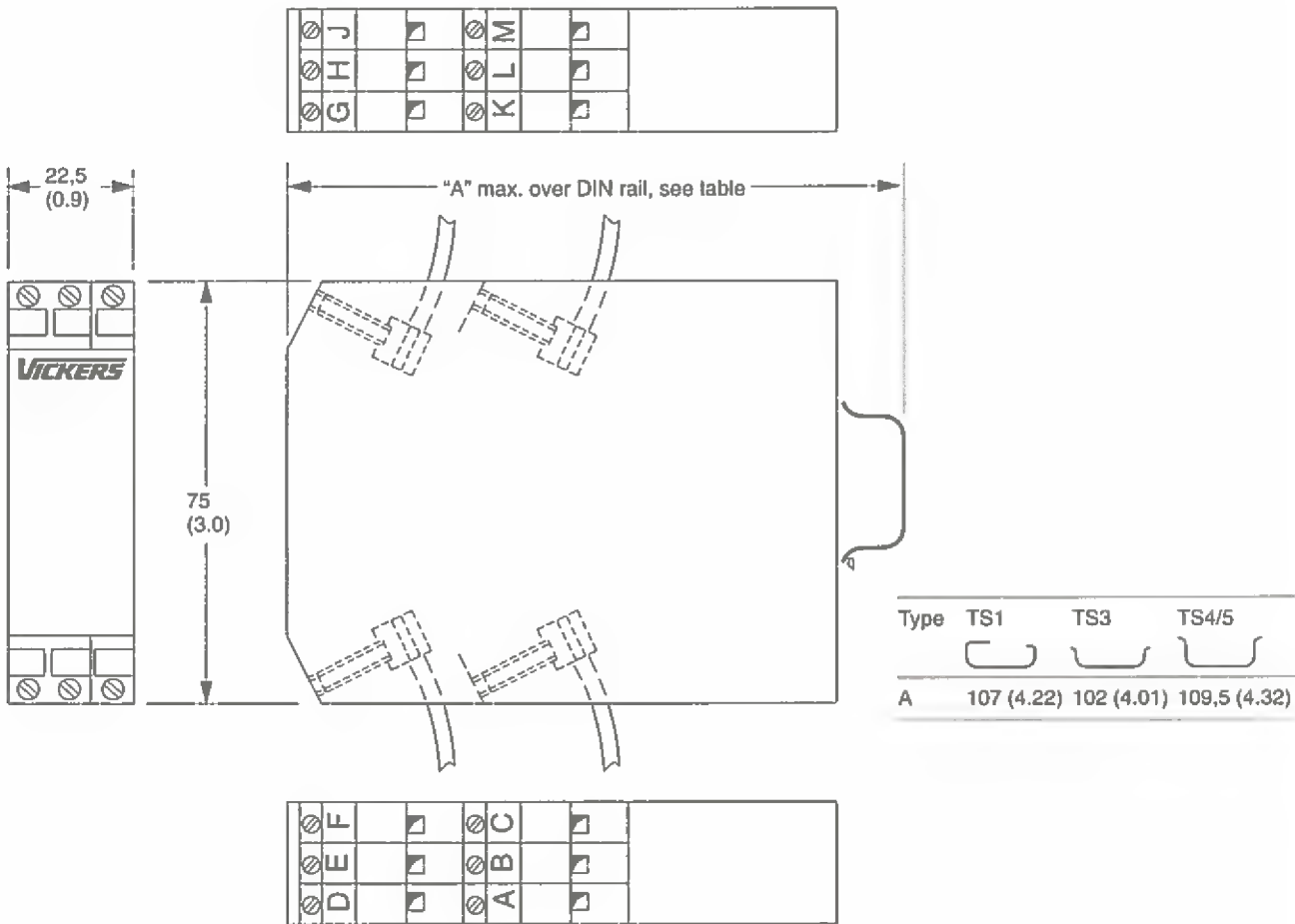
In all cases, both valve and cable should be kept as far away as possible from any source of electromagnetic radiation such as cables carrying heavy current, relays and certain kinds of portable radio transmitters, etc. Difficult environments could mean that extra screening may be necessary to avoid the interference.

# Electrical Block Diagram



↓ Customer's protective earth connection.

## Installation Dimensions in mm (inches)



## Switching Power Plug

For Use with Solenoid Operated Valves Rated up to 24V DC  
**EHH-AMP-702-A; 2\* Series**

### General Description

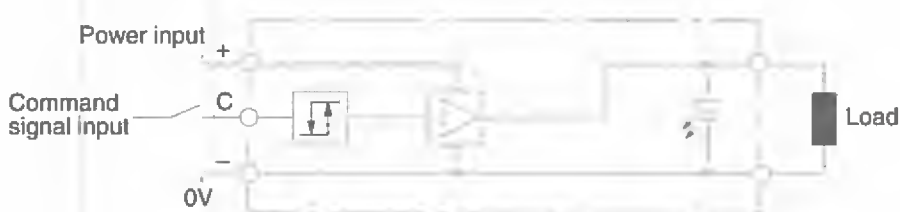
This plug is basically a remote controlled on/off switch. When compared with switching relays, it gives more consistent valve response times and reduced de-energizing times.

Conforming to ISO 4400 (DIN 43650) interface, it has a built-in amplifier that enables the switching control signal for hydraulic and other types of on/off valves to be taken directly to the valve solenoid, instead of via a control cabinet relay.

### Features and Benefits

- Improved control reliability.
- Faster, more consistent load switching.
- Smaller, cooler system control cabinets.
- Low electrically generated noise.
- Simpler, cost effective wiring of the application.
- LED indicates "switched on".
- Same connection interface as conventional ISO 4400 (DIN 43650) plug.
- Protection to IP67.

### Electrical Block Diagram



### Model Codes

**EHH-AMP-702-A - 2\***



#### 1 Type of switch

A = Direct switching of power supply

#### 2 Design number, 20 series

Subject to change.

Installation dimensions unaltered for design numbers 20 to 29 inclusive.



This product has been designed and tested to meet specific standards outlined in the European Electromagnetic Compatibility Directive (EMC) 89/336/EEC, amended by 91/263/EEC, 92/31/EEC and 93/68/EEC, article 5. For instructions on installation requirements to achieve effective protection levels, see this leaflet and the Installation Wiring Practices for Vickers Electronic Products leaflet 2468. Wiring practices relevant to this Directive are indicated by Electromagnetic Compatibility (EMC).

GB-2122D

## Operating Data

### Electrical

Power input voltage▲	24V DC (20-30V DC) including $\pm 10\%$ maximum ripple (peak-to-peak) 24V DC nominal
Reverse polarity protection	No
Command signal: For "ON" For "OFF"	$R_i = 2,4 \text{ k}\Omega$ 13-30V DC 0-6V DC
Output current: Peak Continuous	2,1A 2A
Output voltage	Typically 0,8V below input V
Load	Any resistive or inductive load. Typical load: Vickers DG4V-3 or DG4V-5 solenoid operated directional valve, including when used as a pilot valve.
Max. switching frequency at 50% duty cycles: 350 mH load DG4V-3 valve sol. DG4V-5 valve sol.	5 Hz 4 Hz 3 Hz
Protection	IEC 529; IP67 (when correctly installed with interface seal)
Isolation to VDE 0110	Group B
Electromagnetic compatibility (EMC): Emission Immunity	EN 50081-2 EN 50082-2

▲ Connect 24V to "+" terminal; 0V to "-" terminal.



**Warning:** Reverse polarity connection can cause damage.

### Mechanical

Housing	PA6 glass reinforced plastic (conforms to UL-94HB). Color: gray
Mounting interface	ISO 4400 (DIN 43650). Pin locations can be turned through 180°; polarity unchanged.
Cable clamp	Pg 9 screw type
Cable diameter	Ø5 to 10 mm (0.197 to 0.394 dia)
Wire section	0,5-1,0 mm <sup>2</sup> (20-17 AWG)
Temperature, ambient range	-20° to +70°C (-4° to +158°F)
Mass	0,07 kg (0.154 lb)

## Performance Data

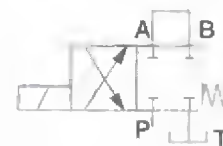
### Typical valve response times ■

Comparisons of response times of sample Vickers valves (circuited as shown on the right) when controlled from remotely located power relay and EHH-AMP-702-A-20.

Valve model	Response time (ms): Remote switching	EHH-AMP-702-A-20 plug
Energizing valve		
DG4V-3	50	50
DG4V-5	50	50
De-energizing valve		
DG4V-3	142	40
DG4V-5	150	45

■ Typical data only: valve response times will vary with spool type, system pressure and flow, volume of fluid under compression, supply voltage, coil temperature, etc.

### Single Solenoid Valve Test Conditions

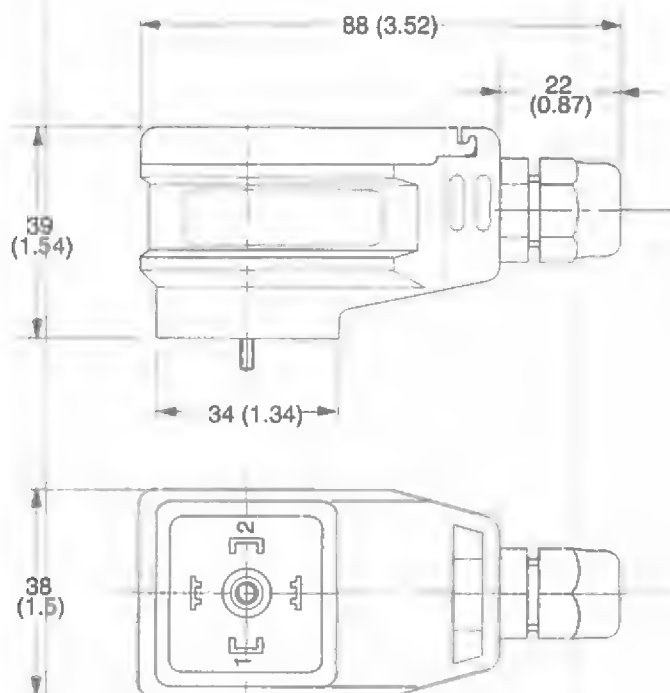


Pressure: 160 bar (2320 psi)  
Flow rate: 60 l/min (16 USgpm)  
Temperature: 55°C (131°F)  
Power supply: 24V DC  
Input signal ◆: 12V DC

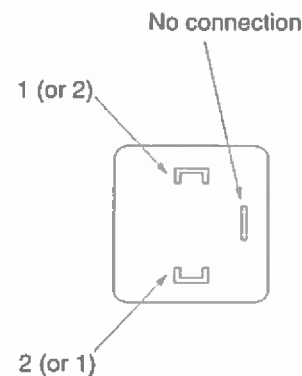
◆ Switching signal to power plug.

## Installation Dimensions in mm (inches)

3rd angle  
projection

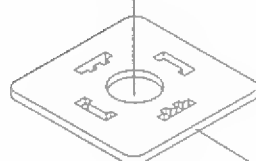
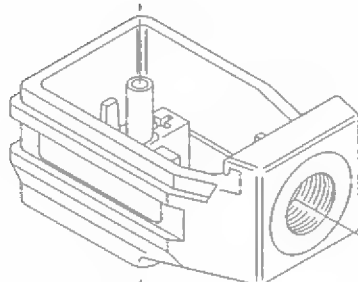
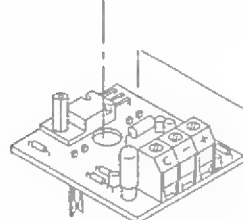
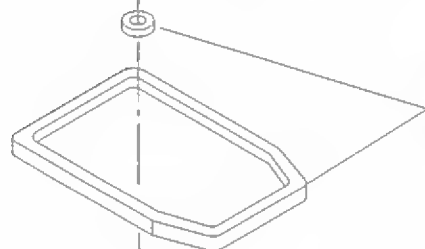
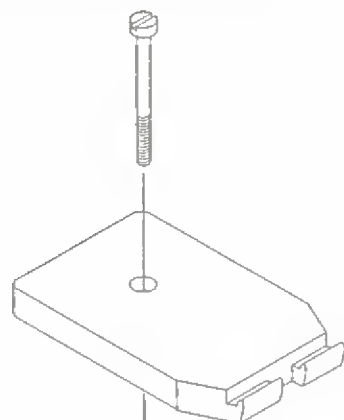


### Solenoid Connections



# Installation Data

## Assembly Showing Wiring Connection Points



### Warning

- Wire the plug for correct polarity. Wrong polarities can cause plug burn-out and/or machine malfunction.
- Tighten the cable clamp to secure the cable.
- Do not connect, or disconnect the plug while power is on.

### WARNING

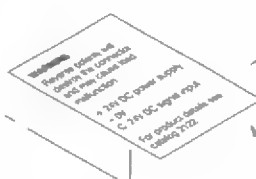
Reverse polarity will destroy the connector and may cause load malfunction.

+: 24V DC power supply

–: 0V

C: 24V DC signal input

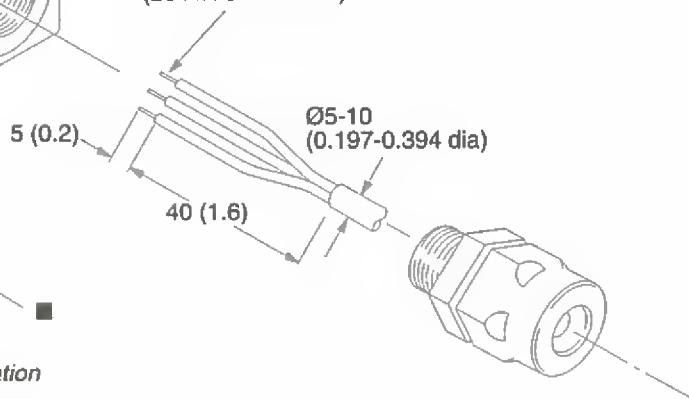
For product details see catalog 2122



After observing the printed warning this adhesive label may be peeled off the amplifier and discarded

### Wiring Preparation

$3 \times 0,5-1,0 \text{ mm}^2$   
(20 AWG-17 AWG)



■ All seals must be fitted correctly at plug installation to provide protection to IP67 (IEC 529).



---

### Start-Up Procedure

With the plug correctly wired but not mounted to the load, provide it with 24V power supply.

Apply a 13V to 30V DC (24V nominal) command signal and check that the integral LED illuminates. Reduce the signal to  $\leq 6V$  DC (or open circuit) and check that the LED goes out.

If there is a malfunction of the LED replace the plug.

Switch off the power supply and the command signal and connect the plug to the load. Ensure that the interface seal is correctly fitted and clamped between the mounting faces (essential for IP67 protection). Tighten the retaining screw.

Ensure that no damage or injury will occur on the machine when the valve is operated.

Switch on the power supply. Apply a command signal to:

- (a) illuminate the LED and,
- (b) energize the load (e.g. solenoid valve).

If the LED does not illuminate there is a short circuit in the load. Replace the load/load coil.

Successful completion of these steps means that the plug and load are ready for normal use.

### Spare Parts

The only spare part available is the interface seal, part number 732100.

### Ordering Procedure

Order plugs by full model code, e.g. EHH-AMP-702-A-20, and spare interface seals by part number 732100.

## “Soft Switch” Power Plugs

### EHH-AMP-702-C; 2\* Series

For use with valve types:

KDG4V-3(S)-H7-6\*  
KTG4V-3(S)-H7-6\*  
KDG4V-5-H\*-3\*  
KTG4V-5-H7-3\*  
KCG-3/6/8-H1-1\*  
KX(C)G-6/8-H1-1\*  
KDG5V-5/7/8-H1-1\*  
CMX\*\*\*-E-G  
EPV\*\*-12D-1\*  
ERV1/2\*\*-12D-1\*  
EPFR1\*\*-12D-1\*

### General Description

These plugs, conforming to ISO 4400/ DIN 43650 interface, offer adjustable, ramped on/off switching times through the use of an integral amplifier.

The switching time range is 50 ms to 5 seconds.

The soft switch plug is rated for 24V DC nominal and controlled by a 24V logic signal. Applying an “on” signal causes the output current to ramp up to, and stay at, an adjustable maximum while the “on” signal is maintained. At “switch-off” the output current is ramped down to zero and will remain at zero until the next “on” signal.

Ramp times (switching times) can be adjusted by an in-built potentiometer.

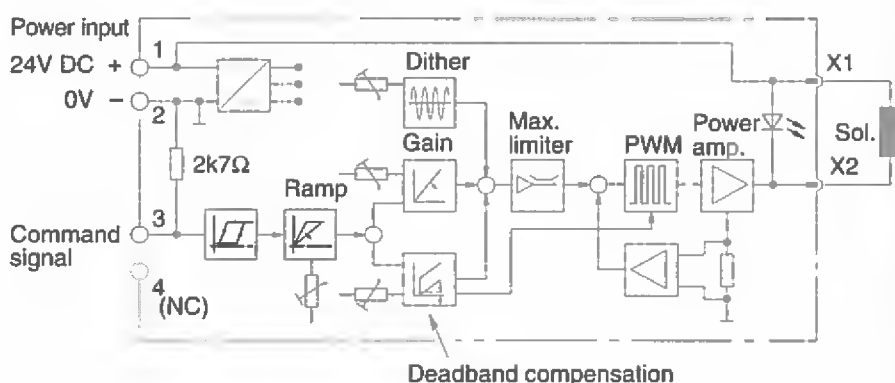
An adjustment also allows for compensation of any deadband in the valve.

### Features and Benefits

- Integral amplifier provides control from on/off logic command signal
- Adjustable ramp time
- Deadband compensation
- Adjustable output level

- Adjustable dither
- EMC to latest European standards
- Improved switching time repeatability
- Fully short-circuit and reverse-polarity protected
- Protection to IP67

### Electrical Block Diagram



This product has been designed and tested to meet specific standards outlined in the European Electromagnetic Compatibility Directive (EMC) 89/336/EEC, amended by 91/263/EEC, 92/31/EEC and 93/68/EEC, article 5. For instructions on installation requirements to achieve effective protection levels, see this leaflet and the Installation Wiring Practices for Vickers Electronic Products leaflet 2468. Wiring practices relevant to this Directive are indicated by Electromagnetic Compatibility (EMC).

## Application and Model Code

---

### Application

Focus applications for this plug are in the control of hydraulic solenoid-operated directional and pressure control valves where control of valve response time can significantly reduce shocks in the hydraulic system.

Best results in reducing hydraulic shocks will only be obtained by using valves with the right "low shock", or "proportional" features.

### Model Code

**EHH-AMP-702- C - 2\***



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#### **1 Design number, 20 series**

Subject to change. Installation dimensions unaltered for design numbers 20 to 29 inclusive.

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## Operating Data

### Electrical

Connections:	
1	24V DC
2	0V (power and signal)
3	Positive command signal
4	Negative command signal
Power (input) supply	20-30V DC including $\pm 10\%$ maximum ripple (peak-to-peak) 24V DC nominal
Absolute maximum voltage	40V
Max. power consumption incl. solenoid	35W
Reverse polarity protected	Yes
Short circuit protected	Yes
Maximum output current	1,6A
Max. output voltage typical (1,6A output current)	Typically 1,5V below supply voltage
Command signal:	
For output (LED ON)	15V to 24V
For no output (LED OFF)	0V to 5V
Input impedance	2700 ohms
Deadband adjustment range	<100 - 1000 mA
Gain adjustment range	0,2A to 1,6A (maximum)
Dither adjustment range	0 to 500 mA
Ramp time	50 ms to 5s
PWM frequency	1200 Hz $\pm 10\%$
Dither frequency	120 Hz $\pm 10\%$
Protection	IEC 529: IP67 (when correctly installed with interface seal in place) Fully short-circuit and reverse-polarity protected
Isolation to VDE 0110	Group "B"
Electromagnetic compatibility (EMC):	
Emission	EN 50081-2
Immunity	EN 50082-2

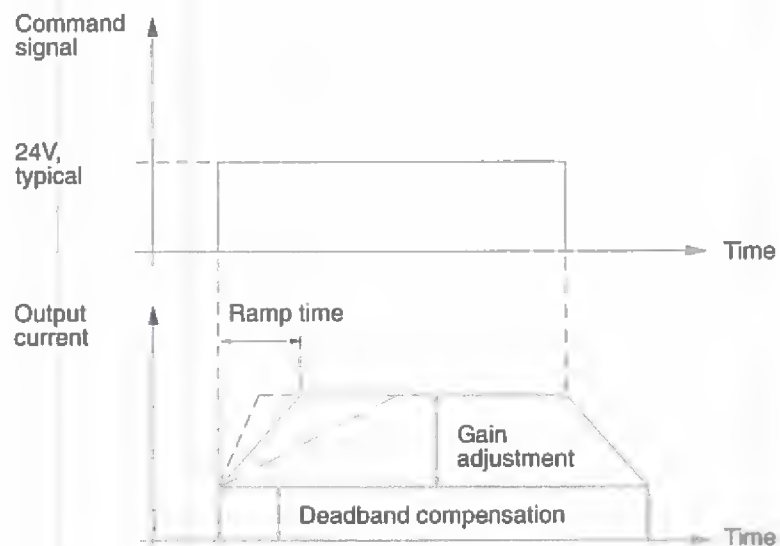
### Mechanical

Housing	PA6 glass reinforced plastic (conforms to UL-94HB). Color: gray
Mounting interface	ISO 4400 (DIN 43650)
Cable clamp	Pg 9 screw type
Cable diameter	Ø 5 to 10 mm (0.197 to 0.394" dia)
Wire section	0,5-1,0 mm <sup>2</sup> (20-17 AWG)
Temperature, ambient range	-20 to +70°C (-4 to +158°F)
Mass	0,07 kg (0.154 lb)

## Functions

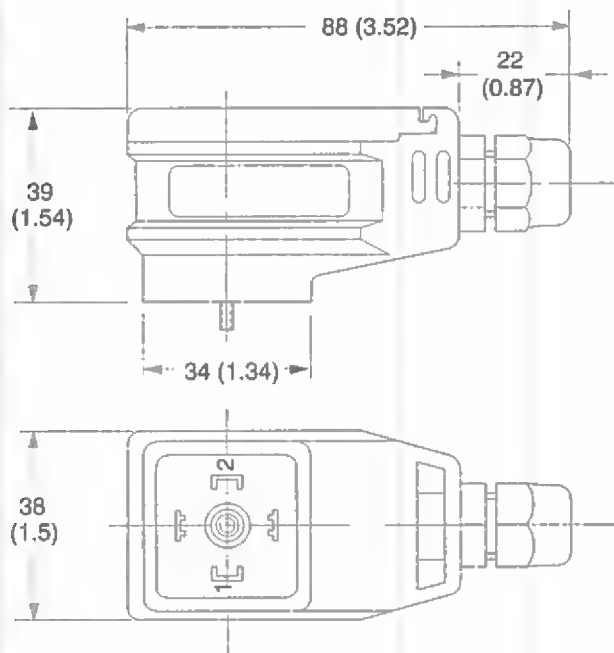
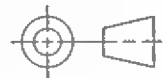
- Switch-on/off: after switching on with a 15V signal the amplifier will remain in the "on" condition with a command signal above 6V. The command signal must be reduced to below 5V to achieve switch-off of the amplifier.

## Input/Output Characteristic

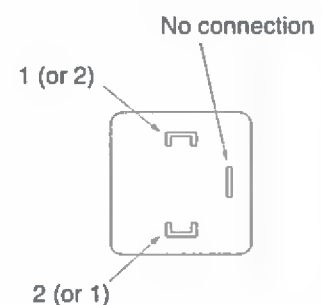


## Installation Dimensions in mm (inches)

3rd angle  
projection

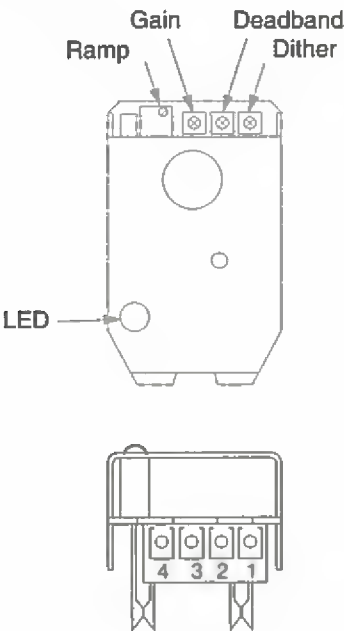


## Solenoid Connections



# Installation Data

## Adjustments



**Ramp time:**  
Turn clockwise to increase ramp time.

**Gain:**  
Turn clockwise to increase gain.

**Deadband compensation:**  
Turn clockwise to increase deadband compensation current.

**Dither:**  
Turn clockwise to increase the dither current.

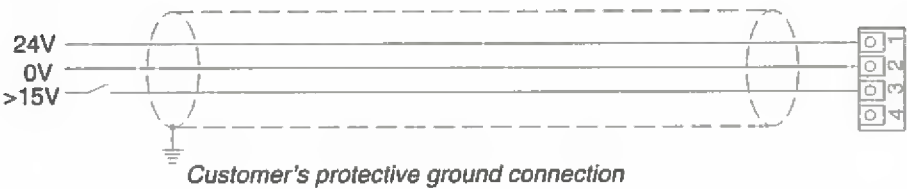
**Terminal 1:**  
Power supply 20V - 30V DC, positive.

**Terminal 2:**  
Power supply 0V.

**Terminal 3:**  
Switch command signal positive.

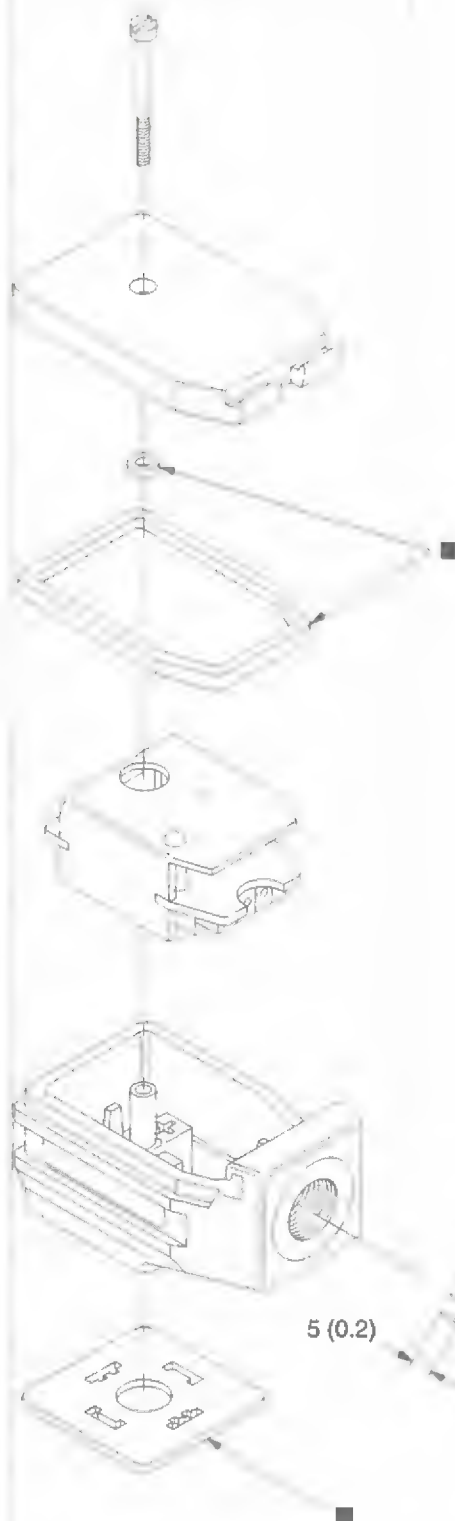
**Terminal 4:**  
Not connected.

## Installation Wiring



**Warning: Electromagnetic Compatibility (EMC)**  
Screened cables should be used and particular attention paid to the grounding of the screens as shown in the above diagram.

## Assembly Showing Wiring Connection Points



### Warning

- Ensure cable clamp nut is adequately tightened to secure the cable.
- Do not connect, or disconnect, the plug while power is on.
- Do not mount, or dismount, the plug while power is on.

### Wiring Preparation

$3 \times 0,5-1,0 \text{ mm}^2$   
(20 AWG-17 AWG)

5 (0.2)

40 (1.6)

Ø5-10  
(0.197-0.394 dia)

■ All seals must be fitted correctly at plug installation to provide protection to IP67 (IEC 529).



---

### Start-Up Procedure

Correctly wire the plug and, before mounting it on the valve solenoid, apply 24V DC (20 to 30V limits) to the "power input" terminals.

Check for correct plug function by illumination/non-illumination of the LED:

- a. Apply less than 2 to 3 volts to the input terminal: the LED should not be illuminated.
- b. Increase voltage: the LED should illuminate when the voltage reaches 15V. *Do not exceed 30V command signal.*
- c. Decrease voltage: the LED should go off when the voltage is less than 5V.

If there is a malfunction a new plug must be fitted.

Switch off power supply and command/input signal and then install plug on solenoid. Ensure that all seals are fitted correctly and clamped as the retaining screw is tightened: *this is essential in providing IP67 protection.*

*Ensure that the hydraulic system will not cause any erratic movement of actuators, then:*

- Switch on power supply again.
- Repeat LED/function check as in 2.

An LED malfunction now indicates a short circuit at the load.

Successful completion of these checks means that the plug and load are ready for use.

### Spare Parts

The only spare part available is the interface seal, part number 732100.

### Ordering Procedure

Order plug by full model code, and spare interface seals by part number 732100.

## Power Plugs for Proportional Valves

### EHH-AMP-702-D/J/K; 2\* Series

For use with valve types:

KDG4V-3(S)-H\*-6\*  
KTG4V-3(S)-H\*-6\*  
KDG4V-5-H\*-3\*  
KTG4V-5-H\*-3\*  
KCG-3/6/8-H1-1\*  
KX(C)G-6/8-H1-1\*  
KDG5V-5/7/8-H1-1\*  
CMX\*\*\*-E-G  
EPV\*\*-12D-1\*  
ERV1/2\*\*-12D-1\*  
EPFR1\*\*-12D-1\*

### General Description

Three types of plugs, conforming to ISO 4400/DIN 43650 interface, with integral amplifiers and necessary adjustment potentiometers, are designed for use with non-feedback hydraulic valves.

This plug/valve combination offers very low cost solutions to many hydraulic control problems requiring proportional control.

Type D is controlled with a 0-10V command signal, and has adjustable gain, ramp, deadband compensation and dither.

Type J, designed for closed-loop applications, is controlled with a 0-10V command signal, and has no ramp function.

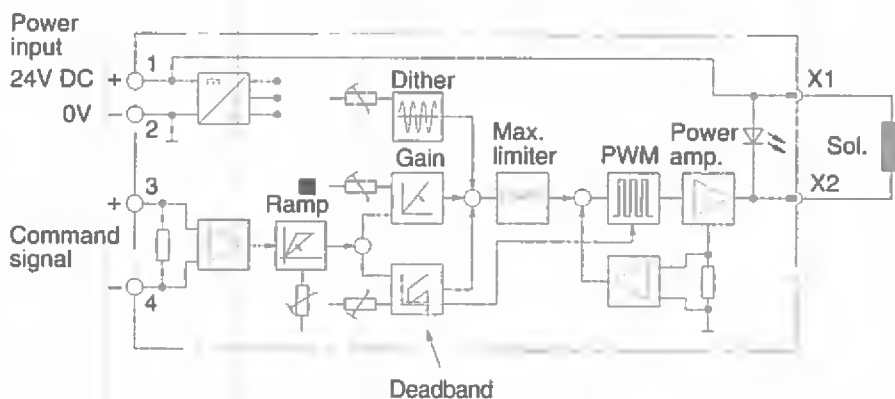
Type K is controlled with a 4-20 mA command signal, and has an adjustable ramp time of 50 ms to 5s.

### Features and Benefits

- Integral amplifier provides essential functions for control of proportional valves
- Adjustable ramp time (types D and K), gain, deadband compensation and dither
- Ease of installation, with reduced cost
- Fully short-circuit and reverse-polarity protected
- Differential voltage command signal (types D and J)
- Adjustable dither
- EMC to latest European standards
- Protection to IP67

### Electrical Block Diagram

EHH-AMP-702-D/J/K-2\*



■ Type J does not have ramp function.



This product has been designed and tested to meet specific standards outlined in the European Electromagnetic Compatibility Directive (EMC) 89/336/EEC, amended by 91/263/EEC, 92/31/EEC and 93/68/EEC, article 5. For instructions on installation requirements to achieve effective protection levels, see this leaflet and the Installation Wiring Practices for Vickers Electronic Products leaflet 2468. Wiring practices relevant to this Directive are indicated by Electromagnetic Compatibility (EMC).

GB-2115E

## Application and Model Codes

### Application

Primary applications are in the control of directly operated, non-feedback proportional valves where the cost of more sophisticated electronic controls can be avoided.

Type J is for closed-loop applications.

### Model Codes

**EHH-AMP-702- \* - 2\***



#### **1 Adjustment range**

- D = Proportional plug: 50 ms to 5s
- J = Proportional plug without ramp function
- K = Proportional plug: 4-20 mA

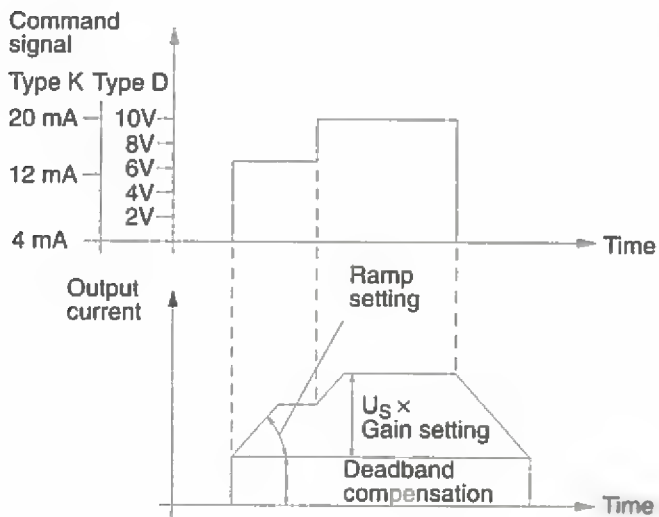
#### **2 Design number, 20 series**

Subject to change. Installation dimensions unaltered for design numbers 20 to 29 inclusive.

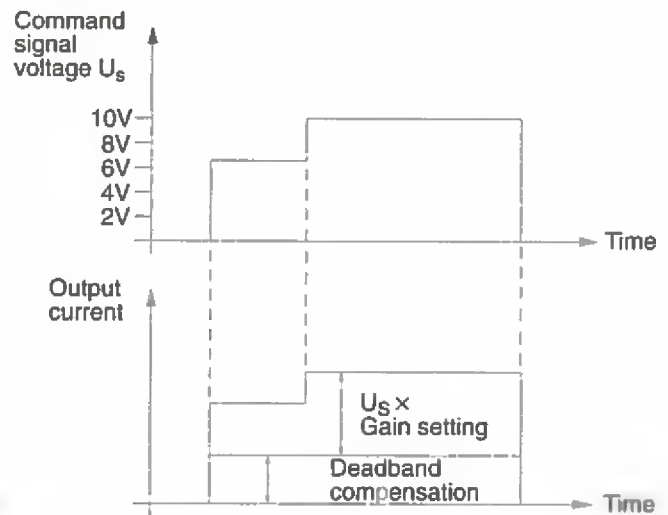
## Operating Data

Electrical		
	Types D and J	Type K
Connections		
1	24V DC	
2	0V (power and signal)	
3	Positive command signal	
4	Negative command signal	
Power (input) supply	20-30V DC including ± 10% maximum ripple (peak-to-peak) 24V DC nominal	
Absolute maximum voltage	40V	
Max. power consumption incl. solenoid	35W	
Reverse polarity protected	Yes	
Short circuit protected	Yes	
Maximum output current	1,6A	
Max. output voltage typical (1,6A output current)	Typically 1,5V below supply voltage	
Command signal	0-10V (10 kΩ)	4-20 mA (250 Ω)
Deadband triggering	200 mV	4 mA
For output (LED ON)	200 mV to 10V	4-20 mA
For no output (LED OFF)	0 mV to 100 mV	0-4 mA
Deadband adjustment range	100 to 1000 mA	
Gain adjustment range	0.02 A/V to 0.16 A/V	0.01 A/mA to 0.08 A/mA
Dither adjustment range	0 to 500 mA	
Ramp time (types D and K only)	50 ms to 5s	
PWM frequency	1200 Hz ± 10%	
Dither frequency	120 Hz ± 10%	
Protection	IEC 529: IP67 (when correctly installed with interface seal in place) Fully short-circuit and reverse-polarity protected	
Isolation to VDE 0110	Group "B"	
Electromagnetic compatibility (EMC):		
Emission	EN 50081-2	
Immunity	EN 50082-2	
Mechanical		
Housing	PA6 glass-reinforced plastic (conforming to UL-94HB). Color: gray	
Mounting interface	ISO 4400 (DIN 43650)	
Cable clamp	Pg9 screw type	
Cable diameter	Ø 5 to 10 mm (0.197 to 0.394" dia)	
Wire section	0,5 to 1,0 mm² (20 AWG-17 AWG)	
Temperature, ambient range	-20° to +70°C (-4° to +158°F)	
Mass	0,07 kg (0.154 lb)	

## Input/Output Characteristics Types D and K

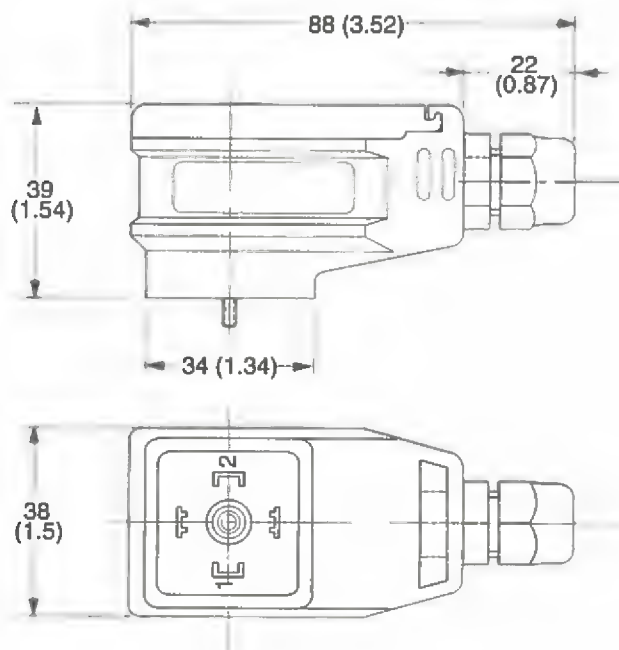


## Type J

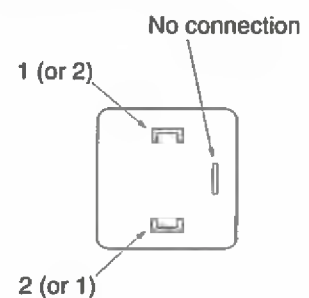


## Installation Dimensions in mm (inches)

3rd angle  
projection

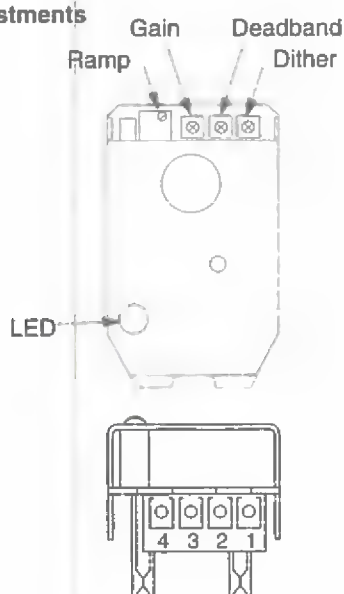


### Solenoid Connections



# Installation Data

## Adjustments



**Ramp time:**  
Turn clockwise to increase ramp time.  
(Only types D/K)

**Gain:**  
Turn clockwise to increase gain.

**Deadband compensation:**  
Turn clockwise to increase deadband compensation current.

**Dither:**  
Turn clockwise to increase the dither current.

**Terminal 1:**  
Power supply 20V-30V DC, positive.

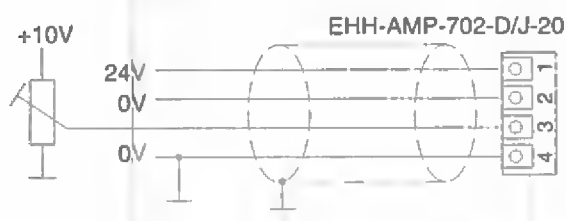
**Terminal 2:**  
Power supply 0V.

**Terminal 3:**  
Command signal positive (see "Operating Data").

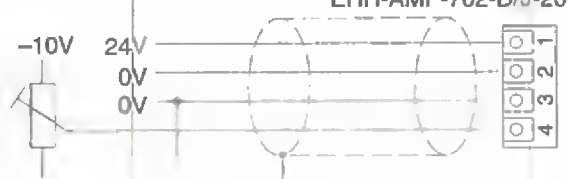
**Terminal 4:**  
Command signal negative (see "Operating Data").

## Installation Wiring Options

### Positive Command Voltage



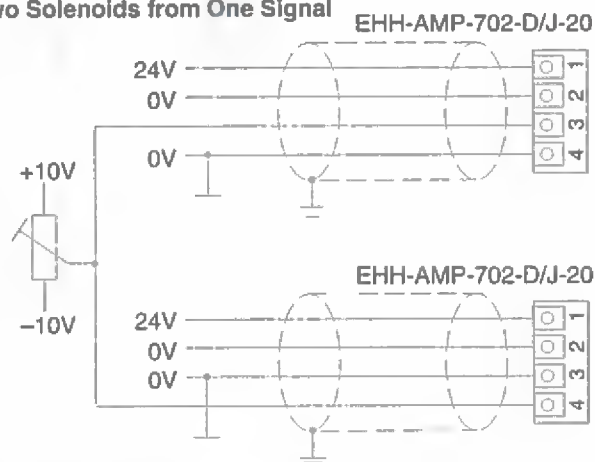
### Negative Command Voltage



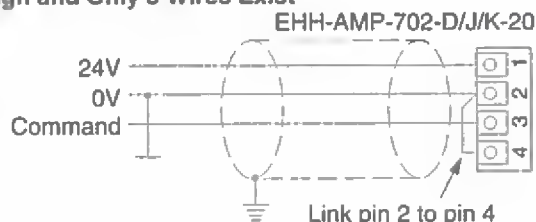
### 4-20 mA Command Signal



### Bi-polar Command Voltage for Operating Two Solenoids from One Signal



### Connections when Replacing 10-Design Power Plug with 20-Design and Only 3 Wires Exist



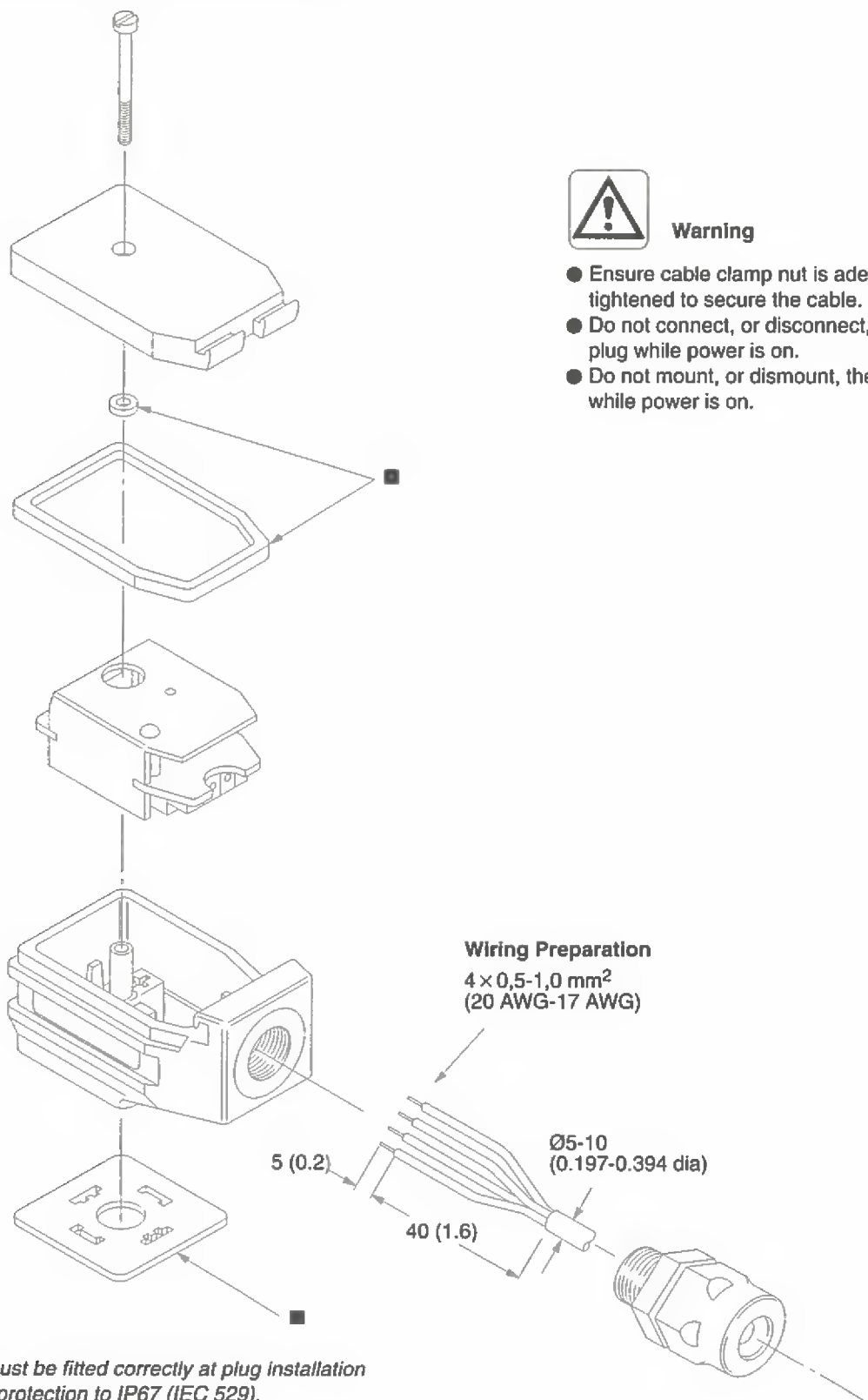
Customer's protective ground connection.



**Warning: Electromagnetic Compatibility (EMC)**

Screened cables should be used and particular attention paid to the grounding of the screens as shown in the above diagrams.

## Assembly Showing Wiring Connection Points





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### Start-Up Procedure

Correctly wire the plug and, before mounting it on the valve solenoid, apply 24 V DC (20 to 30V limits) to the "power input" terminals.

Check for correct plug function by illumination/non-illumination of the LED. The LED should illuminate when the demand applied to the "signal input" terminal is between 200 mV and 10V (or 4 mA and 20 mA) and should not be illuminated when the applied demand is less than 100 mV (4 mA). If there is a malfunction a new plug must be fitted.

Switch off power supply and command/input signal and then install plug on solenoid. Ensure that all seals are fitted correctly and clamped as the retaining screw is tightened: *this is essential in providing IP67 protection.*

*Ensure that the hydraulic system will not cause any erratic movement of actuators, then:*

- Switch on power supply again.
- Repeat LED/function check as in 2.

An LED malfunction now indicates a short circuit at the load.

Successful completion of these checks means that the plug and load are ready for use.

### Spare Parts

The only spare part available is the interface seal, part number 732100.

### Ordering Procedure

Order plug by full model code, and spare interface seals by part number 732100.

# Power Plugs for Proportional Valves (12 volt supply)

## EHH-AMP-712-D/G-2\* Series

For use with valve types:

KDG4V-3(S)-GP7-6\*  
KTG4V-3(S)-GP7-6\*  
KCG-3/6/8-GP1-1\*  
KX(C)G-6/8-GP1-1\*  
KDG5V-5/7/8-GP1-1\*  
CMX\*\*\*-E-G  
EPV\*\*-12D-1\*  
ERV1/2\*\*-12D-1\*  
EPFR1\*\*-12D-1\*

### Features and Benefits

- Integral amplifier provides essential functions for control of proportional valves
- Differential command signal option (type D)
- 5 volt reference option (type G)

- Adjustable ramp time
- Adjustable deadband compensation
- Adjustable gain
- Adjustable dither
- Ease of installation with reduced cost
- EMC to latest European standards
- Fully short-circuit and reverse polarity protected
- Protection to IP67

### General Description

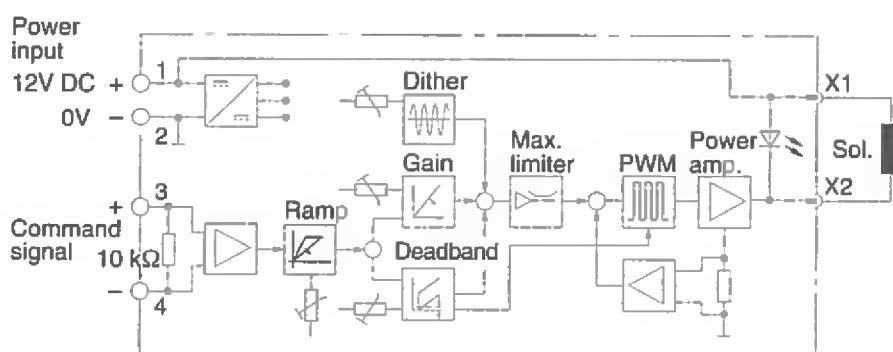
These plugs, conforming to ISO 4400/ DIN 43650 interface, offer low cost solutions for solenoid-operated, non-feedback hydraulic proportional valves through the use of an integral amplifier.

Adjustments of "gain", "ramp time", "deadband" and "dither" can be made directly at the plug.

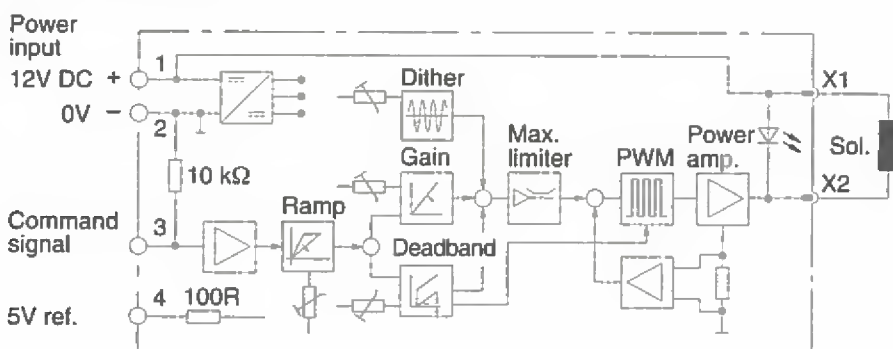
The proportional plugs are controlled with 0-5V or 0-10V command signal to give an output current (adjustable with the gain control) of up to 3A maximum.

### Electrical Block Diagrams

EHH-AMP-712-D-2\*



EHH-AMP-712-G-2\*



This product has been designed and tested to meet specific standards outlined in the European Electromagnetic Compatibility Directive (EMC) 89/336/EEC, amended by 91/263/EEC, 92/31/EEC and 93/68/EEC, article 5. For instructions on installation requirements to achieve effective protection levels, see this leaflet and the Installation Wiring Practices for Vickers Electronic Products leaflet 2468. Wiring practices relevant to this Directive are indicated by Electromagnetic Compatibility (EMC).

GB-2282C

# Application and Model Codes

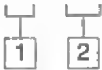
## Application

Primary applications are the control of non-feedback proportional valves where the cost of sophisticated electronic controls can be avoided.

The combination of proportional valve and plug offers very low cost solutions to many hydraulic actuator control problems requiring smooth acceleration and deceleration.

## Model Codes

EHH-AMP-712-\* - 2\*



### 1 Adjustment range

D = 10V differential input: 5s maximum ramp time

G = 5V input: 5s maximum ramp time

### 2 Design number, 20 series

Subject to change. Installation dimension unaltered for design numbers 20-29 inclusive.

## Operating Data

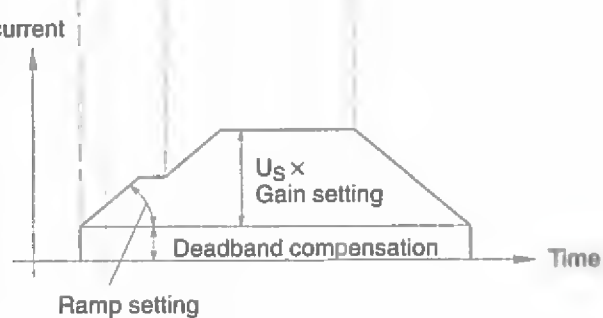
Electrical		
	Type D	Type G
Connections		
1	12V DC	12V DC
2	0V (power and signal)	0V (power and signal)
3	Positive command signal	Positive command signal
4	Negative command signal	5V reference voltage
Power (input) supply	10.2-16V DC including ± 10% maximum ripple (peak-to-peak) 12V DC nominal	
Absolute maximum voltage	36V	
Max. power consumption incl. solenoid	35W	
Reverse polarity protected	Yes	
Short circuit protected	Yes	
Maximum output current	3.0A	
Max. output voltage typical (3A output current)	Typically 1.5V below supply voltage	
Command signal	0-10V (10 kohms)	0-5V (10 kohms)
Deadband triggering	200 mV	200 mV
For output	200 mV to 10V	200 mV to 5V
For no output	0 mV to 100 mV	0 mV to 100 mV
Deadband adjustment range	<100 - 1000 mA	
Gain adjustment range	<0.075 A/V to 0.3 A/V	>0.15 A/V to 0.6 A/V
Dither adjustment range	0 to 500 mA	
Ramp time	50 ms to 5s	
PWM frequency	1200 Hz ± 10%	
Dither frequency	120 Hz ± 10%	
Protection	IEC 529: IP67 (when correctly installed with interface seal in place) Fully short-circuit and reverse-polarity protected	
Isolation to VDE 0110	Group "B"	
Electromagnetic compatibility (EMC):		
Emission	EN 50081-2	
Immunity	EN 50082-2	
Mechanical		
Housing	PA6 glass-reinforced plastic (conforming to UL-94HB). Color: gray	
Mounting interface	ISO 4400 (DIN 43650)	
Cable clamp	Pg9 screw type	
Cable diameter	Ø 5 to 10 mm (0.197 to 0.394 dia)	
Wire section	0,5 to 1,0 mm <sup>2</sup> (0.001 to 0.002 in <sup>2</sup> ) (20 AWG-17 AWG)	
Temperature, ambient range	-20 to 70°C (-4 to +158°F)	
Mass	0,07 kg (0.154 lb)	

## Input/Output Characteristics

Command signal voltage  $U_S$

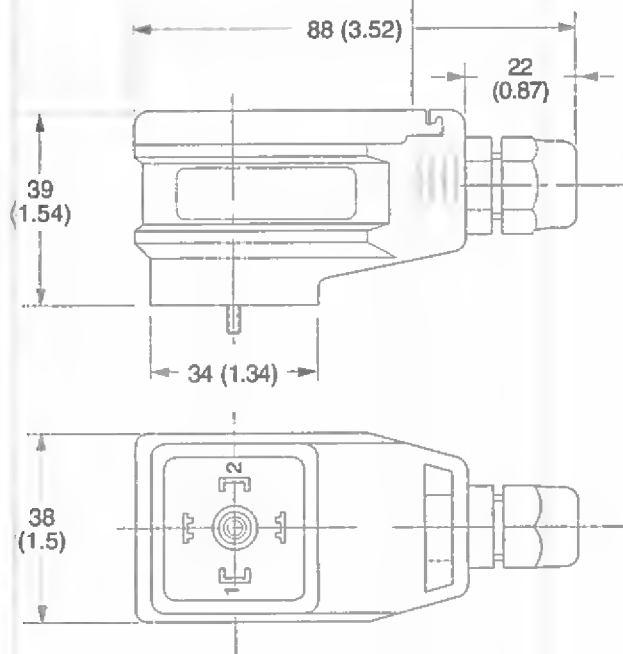


Output current

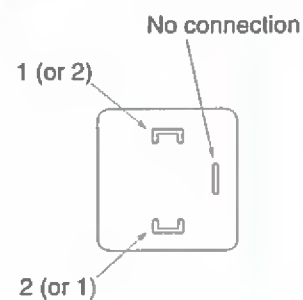


## Installation Dimensions in mm (inches)

3rd angle  
projection

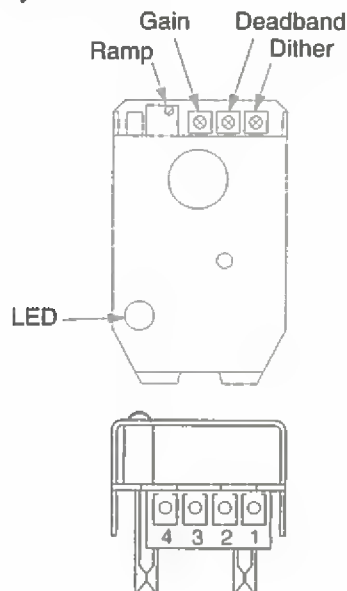


### Solenoid Connections



# Installation Data

## Adjustments



**Ramp time:**  
Turn clockwise to increase ramp time.

**Gain:**  
Turn clockwise to increase gain.

**Deadband compensation:**  
Turn clockwise to increase deadband compensation current.

**Dither:**  
Turn clockwise to increase the dither current.

**Terminal 1:**  
Power supply 10.2V-16V DC, positive.

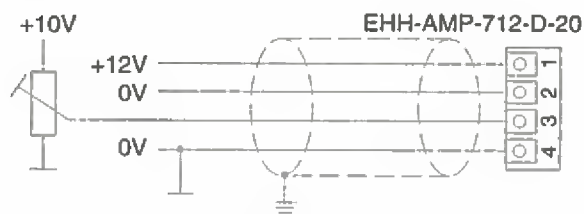
**Terminal 2:**  
Power supply 0V.

**Terminal 3:**  
Command signal positive (see "Operating Data").

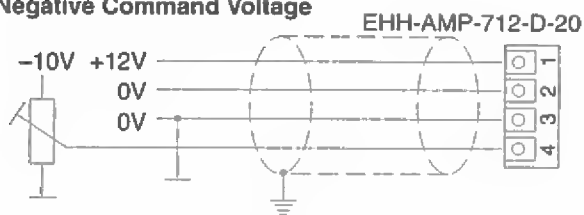
**Terminal 4:**  
Type D: Command signal negative.  
Type G: +5V reference.

## Installation Wiring Options

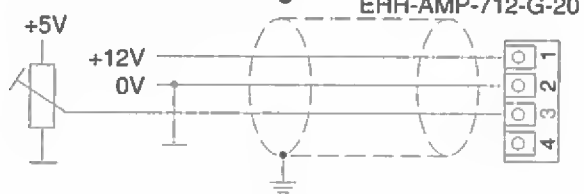
### Positive Command Voltage



### Negative Command Voltage

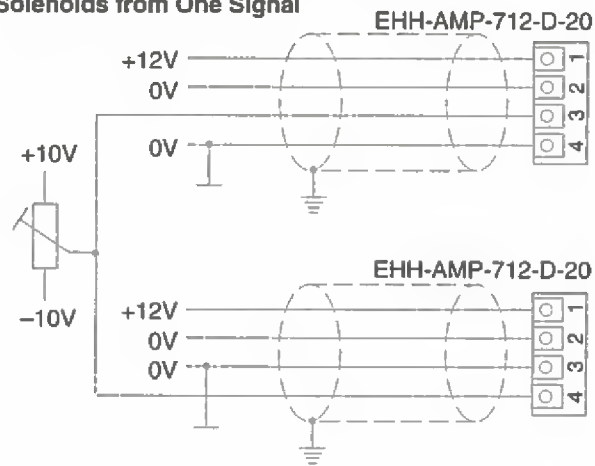


### External 5V Command Signal

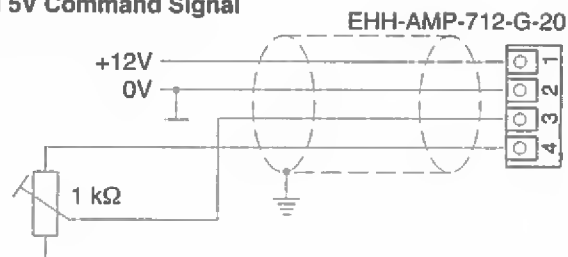


Customer's protective ground connection.

### Bi-polar Command Voltage for Operating Two Solenoids from One Signal



### Internal 5V Command Signal



**Warning: Electromagnetic Compatibility (EMC)**

Screened cables should be used and particular attention paid to the grounding of the screens as shown in the above diagrams.

## Assembly Showing Wiring Connection Points



### Warning

- Ensure cable clamp nut is adequately tightened to secure the cable.
- Do not connect, or disconnect, the plug while power is on.
- Do not mount, or dismount, the plug while power is on.

### Wiring Preparation

4 × 0,5-1,0 mm<sup>2</sup>  
(20 AWG-17 AWG)

5 (0.2)

Ø5-10  
(0.197-0.394 dia)

40 (1.6)

■ All seals must be fitted correctly at plug installation to provide protection to IP67 (IEC 529).



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### Start-Up Procedure

Correctly wire the plug (see drawing on previous page) then, before mounting the plug on the valve solenoid, apply 12V DC (10,2 to 16V limits) to the "power input" terminals.

Check for correct plug function by illumination/non-illumination of the LED. The LED should illuminate when the command signal is applied, and should not be illuminated when the signal is less than 100 mV. If there is a malfunction then a new plug must be fitted.

Switch off power supply and command signal and then install the plug on the solenoid. Ensure that the seal is correctly fitted and clamped when the retaining screw is tightened: *this is essential in providing IP67 protection.*

*Ensure that the hydraulic system will not cause any erratic movement of actuators, then:*

- Switch on power supply again.
  - Repeat LED/function check as in 2.
- An LED malfunction now indicates a short circuit at the load.

Successful completion of these checks means that the plug and load are ready for use.

### Spare Parts

The only spare part available is the interface seal, part number 732100.

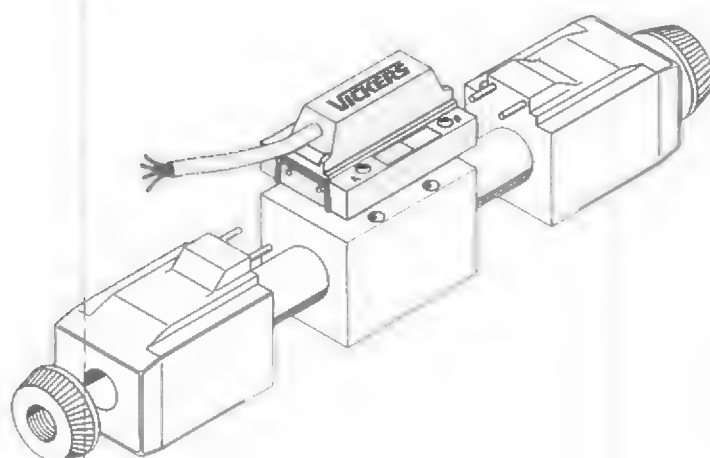
### Ordering Procedure

Order plug by full model code, and spare interface seals by part number.

## Single-Cable UNIPLUG Connector

EHH-AMP-724-A\*\*, 1\* Series; EHH-AMP-724-C\*\*, 1\* Series

EHH-AMP-724-D\*\*, 1\* Series; EHH-AMP-724-Z\*\*, 1\* Series



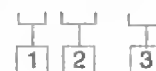
### Features and Benefits

- Ideally suited to use within Vickers bus system
- Reduced wiring costs from use of molded-in cable
- Reduced wiring costs from use of only one cable instead of two for double-solenoid valves
- Reduced number of cable entries in control cabinets
- Smaller electrical cabinet
- Robust connector molding
- IP67 protection class for use in difficult environmental conditions

### Model Codes

UNIPLUG Connector Only

**EHH-AMP-724 \* \*\* - 1\***



### General Description

Vickers UNIPLUG system consists of a solenoid-operated valve fitted with a single-cable electrical connector ideally suited for economical wiring of single and double-solenoid models. It is suitable for use on Vickers ISO 03-size directional and proportional valves which are fitted with the appropriate plug-in coils.

The UNIPLUG connector is released in four 24V versions, offering:

- Low power switching of 24V DC solenoids
- "Soft switching" of proportional valves
- Control of proportional valves from low voltage differential input signal
- Direct switching of 24V DC solenoids

The correctly installed UNIPLUG/ valve combination conforms to protection code IEC 529 class IP67.

The UNIPLUG connector is supplied loose for customer assembly to valves, which must be fitted with type "P" plug-in coils.

#### 1 Function

- A = Switching amplifier
- C = "Soft switch" amplifier
- D = Proportional amplifier
- Z = Direct solenoid connection

#### 2 Cable length

- 15 = 1,5m (approx. 5 ft)
- 30 = 3,0m (approx. 10 ft)
- 50 = 5,0m (approx. 16 ft)

#### 3 Design number, 1\* series

Subject to change. Installation dimensions unaltered for design numbers 10 to 19.



This product has been designed and tested to meet specific standards outlined in the European Electromagnetic Compatibility Directive (EMC) 89/336/EEC, amended by 91/263/EEC, 92/31/EEC and 93/68/EEC, article 5. For instructions on installation requirements to achieve effective protection levels, see this leaflet and the Installation Wiring Practices for Vickers Electronic Products leaflet 2468. Wiring practices relative to this Directive are indicated by  Electro Magnetic Compatibility (EMC).

GB-2367C

### Valves with UNIPLUG

Vickers UNIPLUG is suitable for use with the following valve types. The highlighted features in the model codes are specific to, and essential for, correct identification of valves suitable for use with UNIPLUG.

Valve type	Switching (types A and Z)		Proportional (types C and D)	
Directional controls, double solenoid	DG4V-3-*** <b>(L)</b> -**- <b>(V)</b> M-P-H7-60-EN96		KDG4V-3-**C***- <b>(V)</b> M-P-H7-60-EN47	
	DG4V-3S-*** <b>(L)</b> -**- <b>(V)</b> M-P-H5-60-EN96		KDG4V-3S-**C***- <b>(V)</b> M-P-H5-60-EN47	
			KDG5V-**-**C***- <b>(V)</b> M-P-H1-10-EN47	
Directional controls, single solenoid	DG4V-3-*** <b>(L)</b> -**- <b>(V)</b> M-P-H7-60-EN95		KTG4V-3-**B***- <b>(V)</b> M-P-H7-60-EN46	
	DG4V-3S-*** <b>(L)</b> -**- <b>(V)</b> M-P-H5-60-EN95		KTG4V-3S-**B***- <b>(V)</b> M-P-H5-60-EN46	
Pressure controls			KCG-3-***D-Z-M-P-H1-10-EN46	
			KCG-6-W***-Z-M-P-H1-10-EN46	
			KCG-8-W***-Z-M-P-H1-10-EN46	
			KX(C)G-6-W***-3-Z-M-P-H1-10-EN46	
			KX(C)G-8-W***-3-Z-M-P-H1-10-EN46	
Coil Numbers	DG4V-3(S)	865923	KDG4V-3-*	02-124030
			KTG4V-3-*	02-124030
			KCG-3-*	02-124030
			KX(C)G-*	02-124030

## Operating Data

### Common to All Types

Cable: wire size cable sheathing cable screening	1 mm <sup>2</sup> (18 AWG) Polyurethane Types C and D only
Ambient temperature range: operating storage	-20 to +70°C (-4 to +158°F) -25 to +70°C (-13 to +158°F)
Electromagnetic compatibility (EMC): emission immunity	EN50081-2 EN50082-2
Protection class	IEC 529, IP67 when correctly assembled and installed on a designated valve type
Housing material	Ultramid A3 HG3

### Electrical Data, Type A (Not suitable for use with proportional valves)

Plug with integral switching amplifiers for two solenoids.

LEDs show status of output.

Connections (coded to DIN VDE 0293): wire no. 1 wire no. 2 wire no. 3 wire no. 4	Switching command signal: sol. A Switching command signal: sol. B 0V (power and signal) 24V power supply
Power supply (to VDE 0160)	24V DC. Voltage range dependent upon valve specification up to maximum for UNIPLUG only: 20.4V to 30.4V incl. ± 10% ripple 36V DC for less than 100 ms
Max. permissible voltage	
Protection	Reverse polarity protected

Continued on next page

Switching command signal: Energizing (switch on) max. current min. current minimum signal duration De-energizing (switch off) max. command-current Input resistance	13V to 30.2V 10 mA 5 mA 10 ms -2V to +6V 2 mA 2.5 kΩ
Output current per solenoid: continuous maximum absolute maximum	2A 2.1A
Output voltage at 1.6A output current	Typically 1.5V below supply voltage
Max. power consumption incl. one solenoid energized	40W
Maximum switching frequency	5 Hz

#### Electrical Data, Type C

Plug with proportional amplifiers plus an adjustable ramp to give "soft switching" of two solenoids from a switching input signal. LEDs show status of output.

Connections (coded to DIN VDE 0293): wire no. 1 wire no. 2 wire no. 3 wire no. 4 screen	Switching command signal: sol. A Switching command signal: sol. B 0V (power and signal) Power supply Connect to a suitable ground point
Power supply (to VDE 0160) Max. permissible voltage	24V DC (20.4V to 30.4V incl. $\pm 10\%$ ripple) 36V DC for less than 100 ms
Protection	Reverse polarity protected Short circuit protected
Switching command signal: Energizing (switch on) maximum current minimum current minimum signal duration De-energizing (switch off) maximum current Input resistance	13V to 30.2V 10 mA 5 mA 0.1 ms -2V to +6V 2 mA 2.5 kΩ
Output current per solenoid: continuous maximum absolute maximum	1.6A 1.8A
Output voltage at 1.6A output current	Typically 1.5V below supply voltage
Max. power consumption incl. one solenoid energized	35W
Ramp adjustment ▲ range	50 ms to 5 sec
Deadband compensation ▲ independent for each solenoid Trigger level for deadband	0 to 700 mA +/-100 mV
Gain adjustment ▲ range, independent for each solenoid	0.04 to 0.16 A/V
PWM frequency	240 Hz
Installation and start-up guidelines	ML-9144

▲ Vibration can cause potentiometer setting to change by up to approx. 5%. To avoid this effect, it is recommended to seal the adjusting screws (e.g. Loctite Screwlock 222).

Continued on next page

**Electrical Data, Type D**

Plug with proportional amplifiers with independent adjustable gain and deadband for each of two solenoid outputs, plus a common adjustable ramp.

LEDs show status of output.

Connections (coded to DIN VDE 0293): wire no. 1 wire no. 2 wire no. 3 wire no. 4 screen	Positive command signal Negative command signal 0V (power and signal) 24V power supply Connect to a suitable ground point
Power supply (to VDE 0160) Max. permissible voltage	24V DC (20.4V to 30.4V incl. $\pm 10\%$ ripple) 36V DC for less than 100 ms
Protection	Reverse polarity protected Short circuit protected
Differential command signal max. command-current Input resistance Protected against overvoltage	-10V to +10V. See "Command Signal" table on next page 1 mA 10 k $\Omega$ $\pm 50$ volts
Output current per solenoid: rated max.	1.6A 1.8A
Output voltage at 1.6A output current	Typically 1.5V below supply voltage
Max. power consumption with one solenoid energized	35W
Ramp adjustment ■ range	50 ms to 5 sec
Deadband compensation ■, independent for each solenoid Trigger level for deadband	0 to 700 mA +/- 100 mV
Gain adjustment ■ range, independent for each solenoid	0.04 to 0.16 A/V
PWM frequency	240 Hz
Installation and start-up guidelines	ML-9144

■ Vibration can cause potentiometer setting to change by up to approx. 5%. To avoid this effect, it is recommended to seal the adjusting screws (e.g. Loctite Screwlock 222).

**Electrical Data, Type Z (Not suitable for use with proportional valves)**

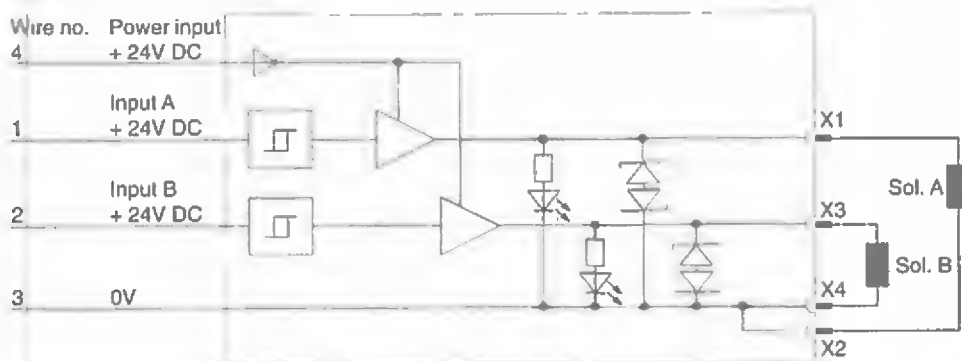
Plug for direct connection to solenoids of switching valves (no integral amplifier).

LEDs show status of power to solenoids.

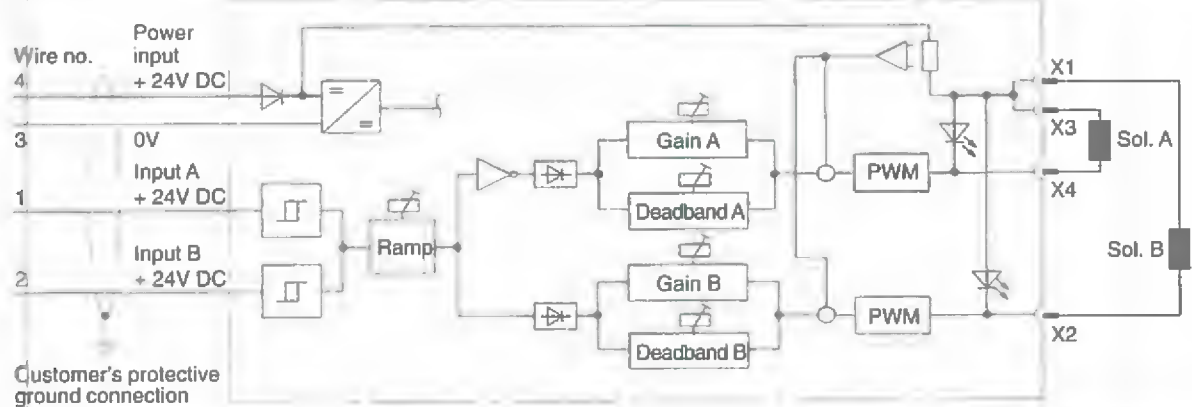
Connections (coded to DIN VDE 0293): wire no. 1 wire no. 2 wire no. 3	Power supply, sol. A Power supply, sol. B Power 0V
Power supply (to VDE 0160)  Max. permissible voltage	24V DC. Voltage range dependent upon valve specification up to maximum for UNIPLUG only: 20.4V to 30.4V incl. $\pm 10\%$ ripple 36V DC for less than 100 ms
Protection	Reverse polarity protected Protection network for inductive load protects switch from high voltages, and speeds de-energizing of solenoid
Max. power consumption with one solenoid energized	40W
Output current per solenoid: continuous maximum absolute maximum	2A 3A
Maximum switching frequency	5 Hz

# Electrical Block Diagrams

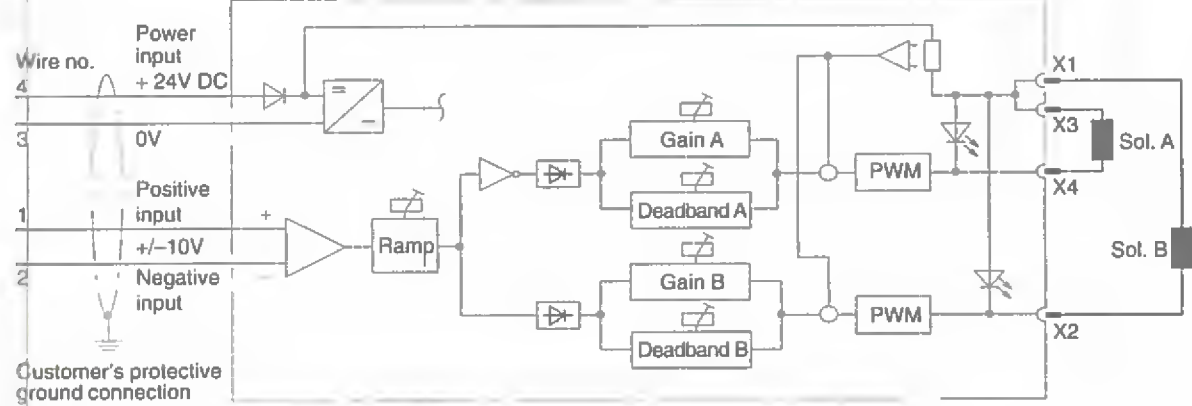
EHH-AMP-724-A\*\*-1\*



EHH-AMP-724-C\*\*-1\*



EHH-AMP-724-D\*\*-1\*



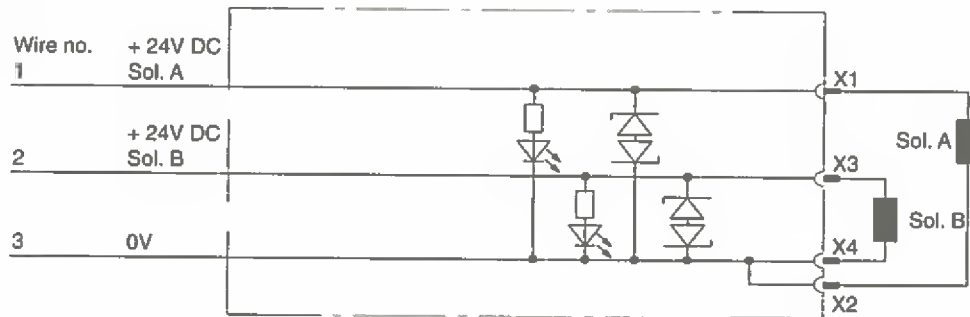
Command Signal Polarity Options		
Type D only		
Wire 1	Wire 2	Output
+	-	A
+	0	A
0	-	A
-	+	B
0	+	B
-	0	B



**WARNING: Electromagnetic Compatibility (EMC)**  
It is necessary to ensure that the valve is wired up in accordance with the connection arrangements shown in this leaflet. For effective protection, the user's electrical cabinet, the valve subplate or manifold and the cable screens should be connected to efficient ground points.  
In all cases, both valve and cable should be kept as far away as possible from any source of electromagnetic radiation such as cables carrying heavy current, relays and certain kinds of portable radio transmitters, etc. Difficult environments could mean that extra screening may be necessary to avoid interference.

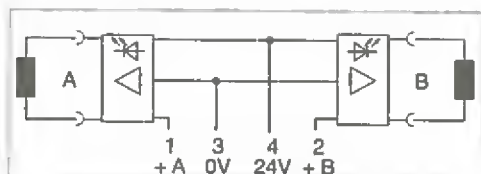


### EHH-AMP-724-Z\*\*-1\*

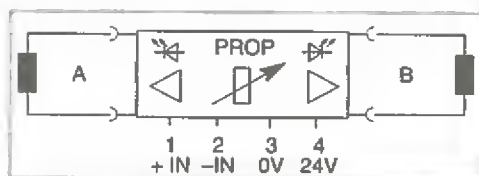


## Identification Symbols on Valve Labels

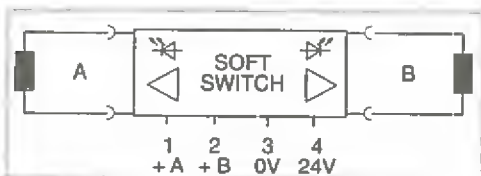
### EHH-AMP-724-A\*\*-1\*



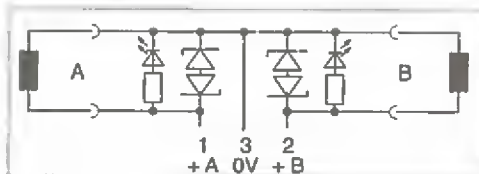
### EHH-AMP-724-D\*\*-1\*



### EHH-AMP-724-C\*\*-1\*



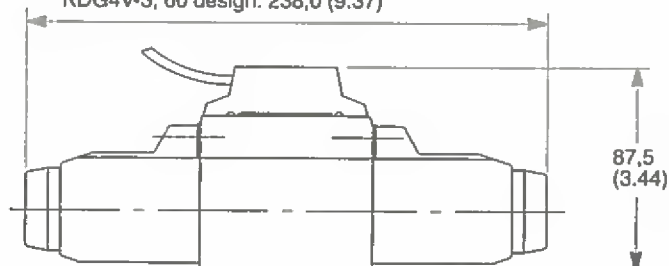
### EHH-AMP-724-Z\*\*-1\*



## UNIPLUG Installed on Typical Valves

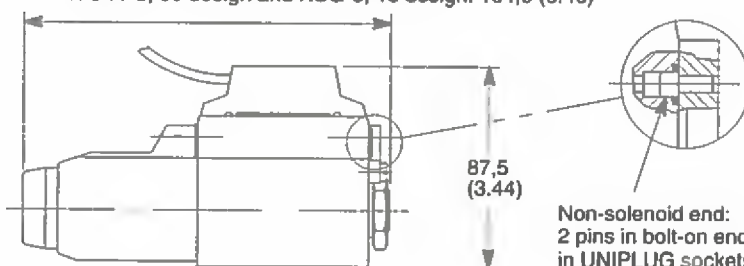
### Double solenoid models

DG4V-3-\*C/N, 60 design: 200,0 (7.87)  
KDG4V-3, 60 design: 238,0 (9.37)



### Single solenoid models

DG4V-3-\*A/B(L), 60 design: 156,0 (6.14)  
KTG4V-3, 60 design and KCG-3, 10 design: 164,0 (6.46)

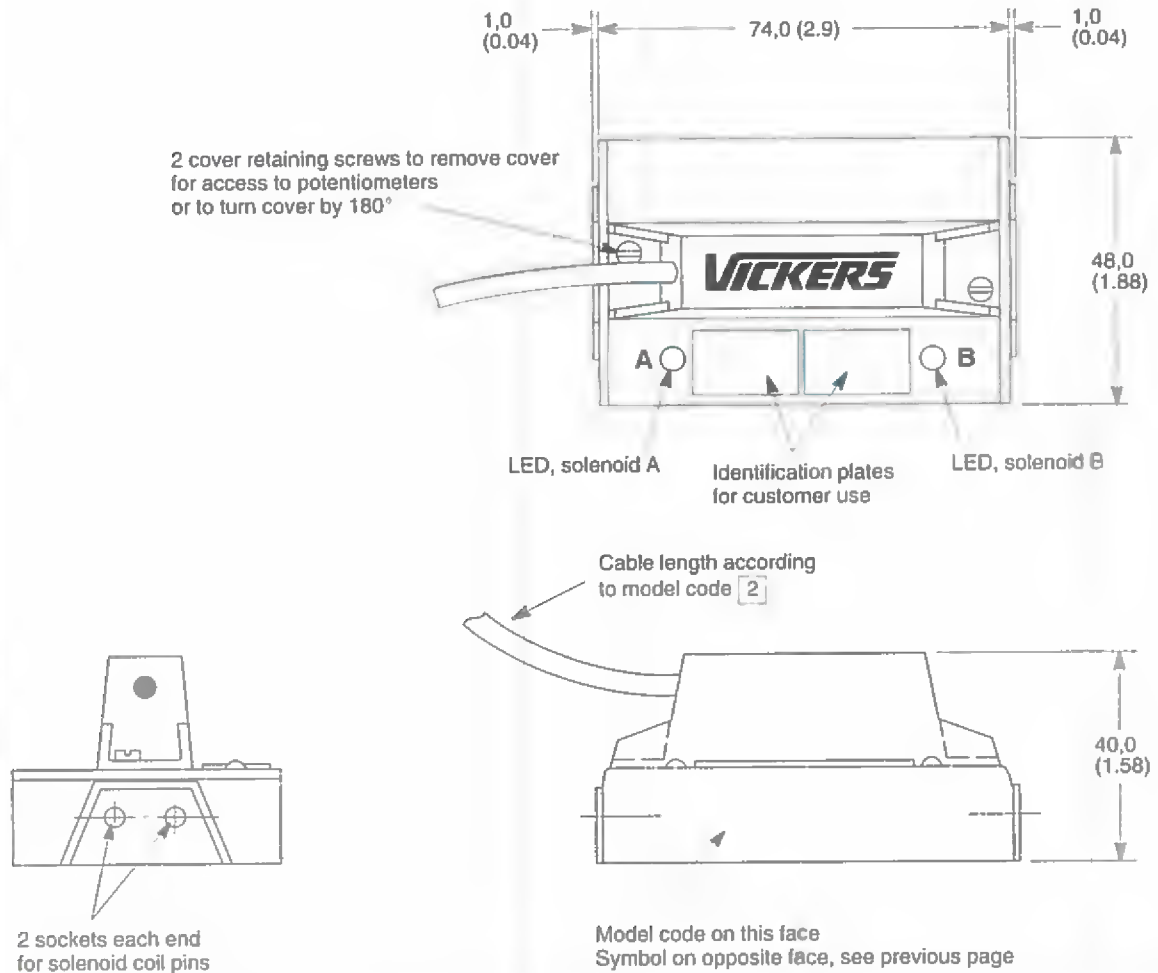
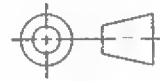




# Installation Dimensions in mm (inches)

All Models

3rd angle  
projection



## Types C and D

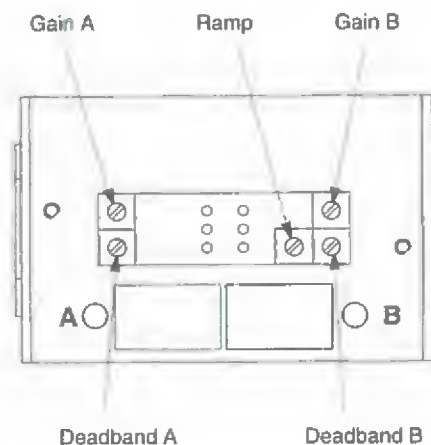
Shown with cover removed for access to potentiometers

### Potentiometer Adjustments

**Ramp:** Turn clockwise to increase ramp time

**Deadband:** Turn clockwise to increase deadband compensation

**Gain:** Turn clockwise to increase gain



## Power Supply Unit 24V DC 10A Max. Output

EHA-PSU-704-A\*\*-2\*

### Model Code

EHA-PSU-704-A \*\* -20

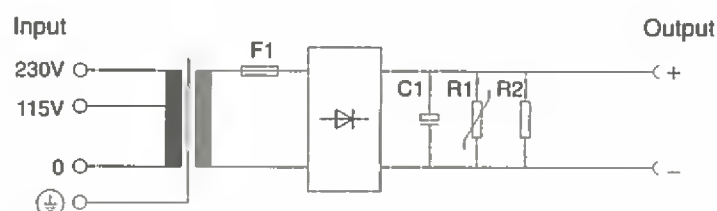


#### 1 Outputs

3.5 = 3,5A  
5.0 = 5,0A  
10 = 10,0A

#### 2 Design number

### Circuit and Connections



### Operating Data

<b>Input</b>				
Rated voltage		115/230V AC $\pm 5\%$		
Rated frequency		50/60 Hz		
Screw-on terminal connections		Max. 4,0 mm <sup>2</sup> (0.006 in <sup>2</sup> )		
<b>Output</b>				
At rated input voltage U <sub>a</sub> to DIN 19240		24V DC		
Ripple, peak-to-peak		<5%		
Screw-on terminal connections		Max. 4,0 mm <sup>2</sup> (0.006 in <sup>2</sup> )		
<b>Output current</b>		Model	A3.5	A5.0
<b>Fuse</b>			3,5A	5,0A
<b>Mass</b>			6,3 AT	8 AT
			2,2 kg	3 kg
			(4.85 lb)	(6.61 lb)
			10A	20 AT
			5,5 kg	
			(12.13 lb)	
<b>Protection</b>		IEC 364-4-41 or HD 384.04.41 (KDE 0100, Part 410)		
<b>Transformer to</b>		VDE 0551/EN 60742/IEC 742		
<b>Temperature range</b>		-20°C to +60°C (-4°F to +140°F)		
<b>Mounting attitude</b>		Optional		



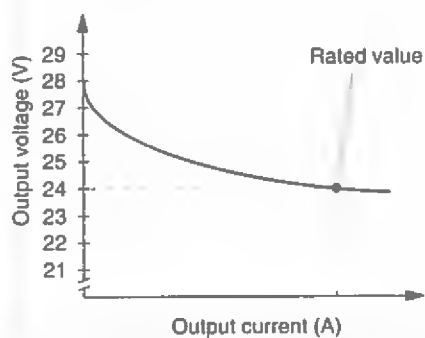
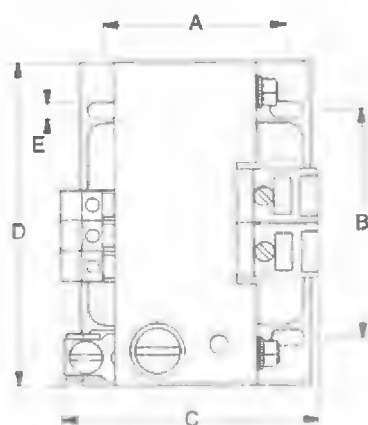
**Warning: Electromagnetic Compatibility (EMC)**

The European Community directives for electromagnetic compatibility (EMC) do not apply to this product.

**Output Voltage/Load Current**

Primary voltage ..... 115/230V AC

Ambient temperature ..... 22°C (72°F)

**Installation Dimensions in mm (inches)****Model A3.5/A5.0****Model A10**

Model	A	B	C	D	E	Overall dimensions
A3.5	59,0 (2.32)	64,0 (2.51)	87,0 (3.43)	84,0 (3.31)	4,8 (0.19)	120 (4.72)
A5.0	75,5 (2.97)	84,0 (3.31)	91,5 (3.60)	96,0 (3.78)	5,8 (0.23)	144 (5.67)
A10	86,5 (3.40)	90,0 (3.54)	105,0 (4.13)	120,0 (4.72)	5,8 (0.23)	170 (6.69)

## Portable Test Equipment for K\*G4V, KF and KH Series Proportional Valves and Associated Vickers Amplifiers

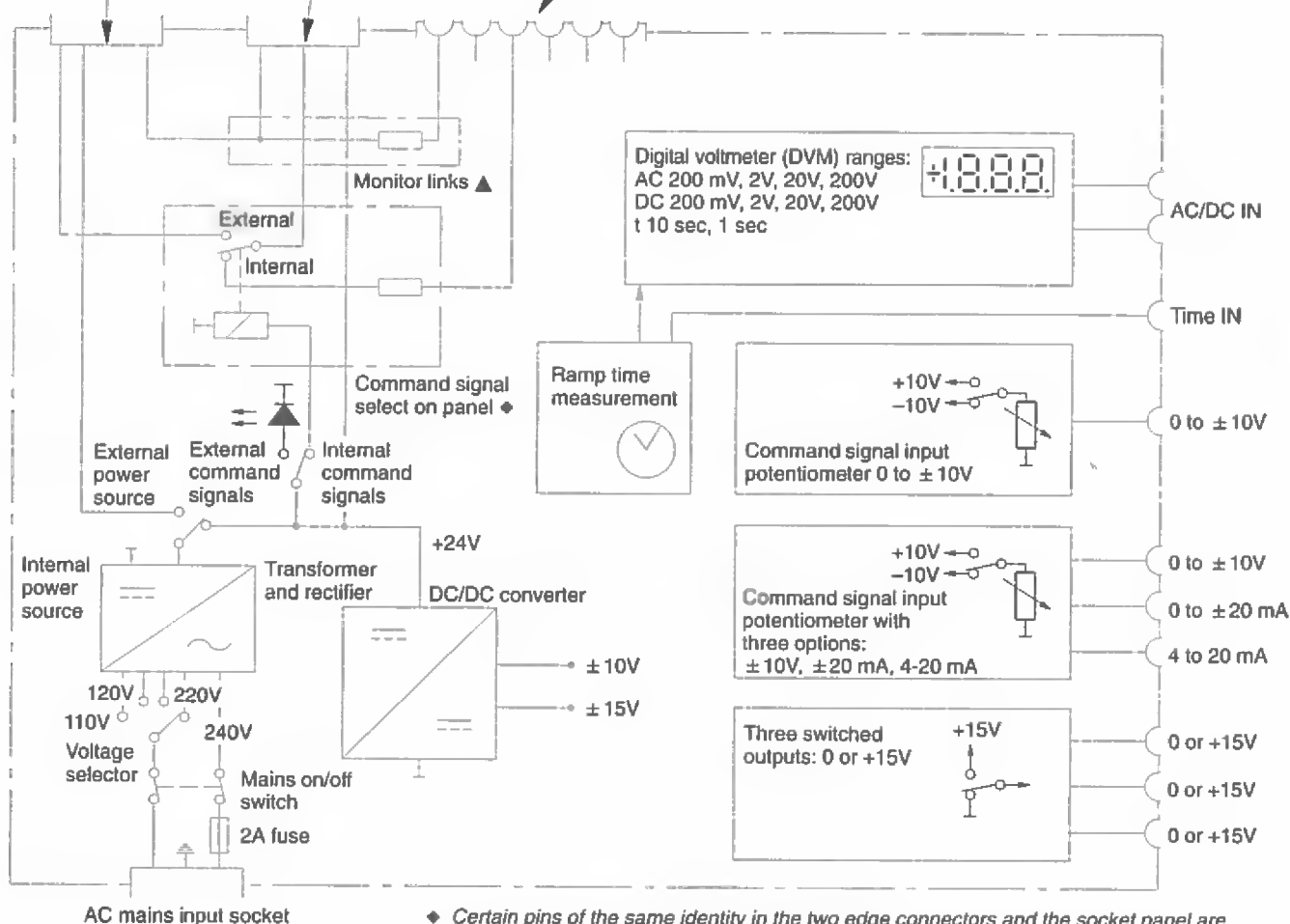
EHA-TEQ-700; 2\* Series

### Circuit and Connections

Edge connector to mate with:  
a. Cable to proportional valve, or  
b. Cable to application electrics  
via attached extender board

Edge connector to mate  
with Vickers amplifier

44 command signal/  
measurement sockets



◆ Certain pins of the same identity in the two edge connectors and the socket panel are linked internally as shown above. These pins are:  
z4, 6, 8, 10, 16, 24  
b4, 6, 8, 10, 12, 16, 18, 20, 24  
d2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28

▲ Other pins of common identity but not listed above are connected as shown.



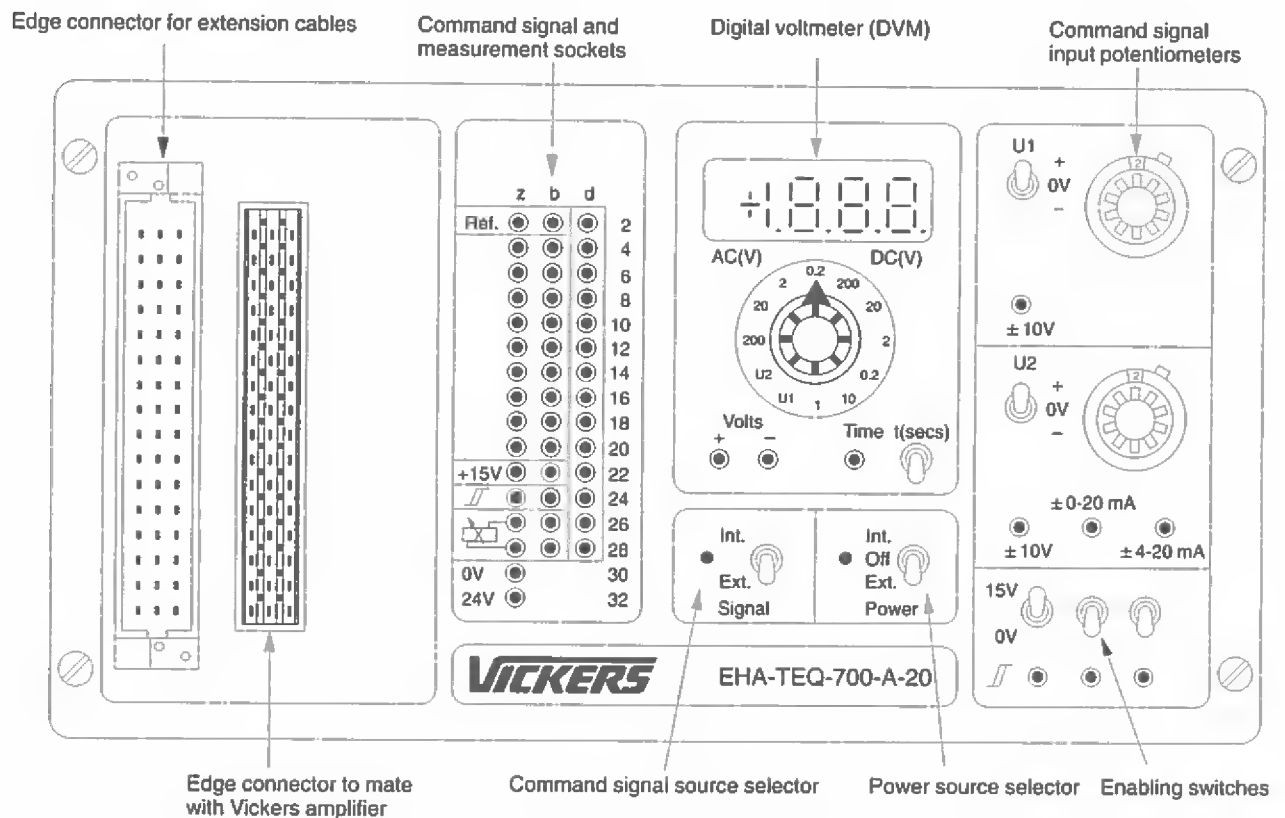
**Warning: Electromagnetic Compatibility (EMC)**

The European Community directives for electromagnetic compatibility (EMC) do not apply to this product.

## Operating Data

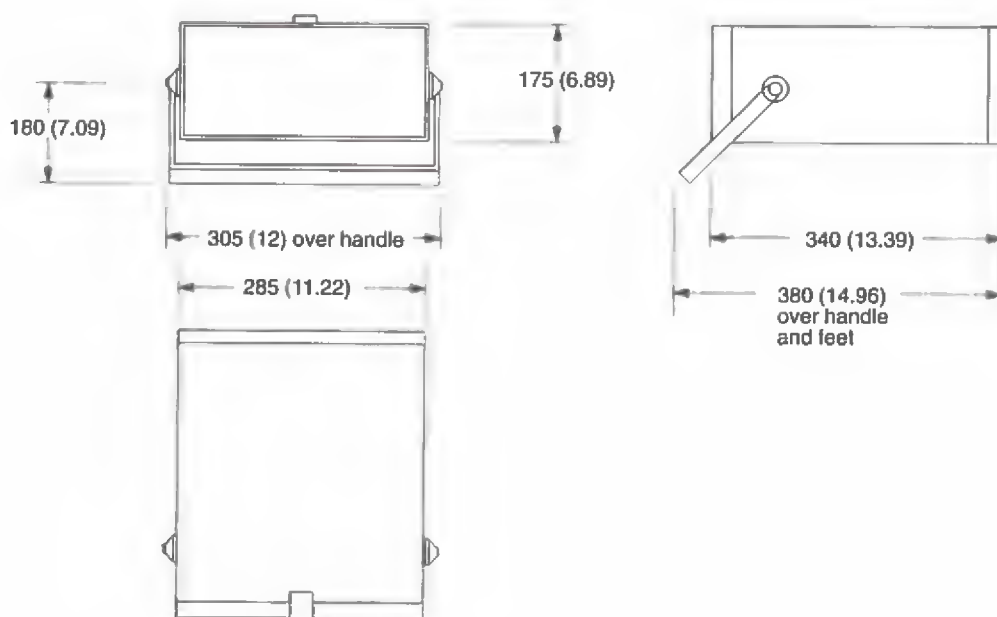
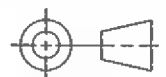
Scope	An aid to commissioning specified Vickers proportional valves, amplifiers and their applications. Checks and measurements of their parameters can be made.
Features:	
Mains power supply	110/130/220/240V (+10 to -15%) AC 50/60 Hz (100 VA max.)
Power supply to amplifier under test	24V DC (40W max.) internally from AC/DC converter or externally from application electrics. Panel-mounted change-over switch.
Command signal source selector	Panel-mounted switch. Internal or application source; LED indication of latter.
AC or DC voltage measurements	Digital voltmeter (DVM), 3.5-digit display. Panel-mounted.
Ramp time/pulse measurement	Two-range timer offering selection of 0-1 or 0-10 sec ranges.
Voltage or current command signals	Two independent panel-mounted potentiometers with polarity selectors.
Command signal enabling	Three independent panel-mounted switches and output sockets.
Measurement and/or command signal input sockets	44 x Ø 2 (0.0787 dia.) sockets, access to DIN 41612 F48 edge connector pins.
Connector for Vickers amplifier	DIN 41612 F48 edge connector.
Connector to machine electrics or Vickers proportional valves	DIN 41612 F48 edge connector for flying leads.
Casing	Standard enclosure with carrying handle.
Control panel	See next page
Accessories supplied loose with EHA-TEQ-700	<ul style="list-style-type: none"> <li>a. Mains lead. User to supply and fit mains plug.</li> <li>b. Connecting lead to proportional valve.</li> <li>c. Lead and extender board. For connecting application electrics to test equipment.</li> <li>d. 30 x Ø 2 (0.0787 dia.) plug leads for control panel connections.</li> <li>e. Operating manual.</li> </ul>
Operating modes Note: All connections made with accessories supplied with the EHA-TEQ-700. Command input signals and monitor points are selected on the front panel with the jumper leads also supplied.	<ul style="list-style-type: none"> <li>a. To monitor an application by connecting EHA-TEQ-700 to a DIN 41612 F48 edge connector on the application.</li> <li>b. To drive an installed proportional valve independently of the application electrics by connecting the EHA-TEQ-700 directly to the valve.</li> <li>c. To bench-test a Vickers amplifier and the spool movement of the associated proportional valve. A pilot pressure supply will be needed when testing a two-stage valve.</li> </ul>
Installation dimensions	See next page
Mass	6,8 kg (15 lb) approx., including accessories.

## Control Panel



## Installation Dimensions in mm (inches)

3rd angle projection



## Eurocard Test Adaptor

EBA-TEQ-706-A-10

### General Description

This low cost test equipment is designed for easy connection to a standard Vickers Eurocard-format, EEA-PAM-5\*\* series amplifier, to facilitate voltage and current measurements during set-up or fault diagnosis. The Vickers EEA-PAM-5\*\* series amplifiers have a common edge connector pin arrangement which allows the test equipment to be used for all amplifiers in the series.

The amplifier to be tested is first removed from the control panel or cardholder and the EBA-TEQ-706-A-10 installed in its place. Testing can be started when the amplifier is plugged in to the free end of the test equipment, where it is held by latches.

The -TEQ- panel contains a control potentiometer, switches to select varying circuitry options, and a number of sockets. Four pairs of these sockets are fitted with jumpers which can be removed for current measuring via external meters.

Switchable options are:

- Drive enable/disable
- Ramp enable/disable (only with 30 design amplifiers)
- Internal/external input
- 1:10 command signal attenuation

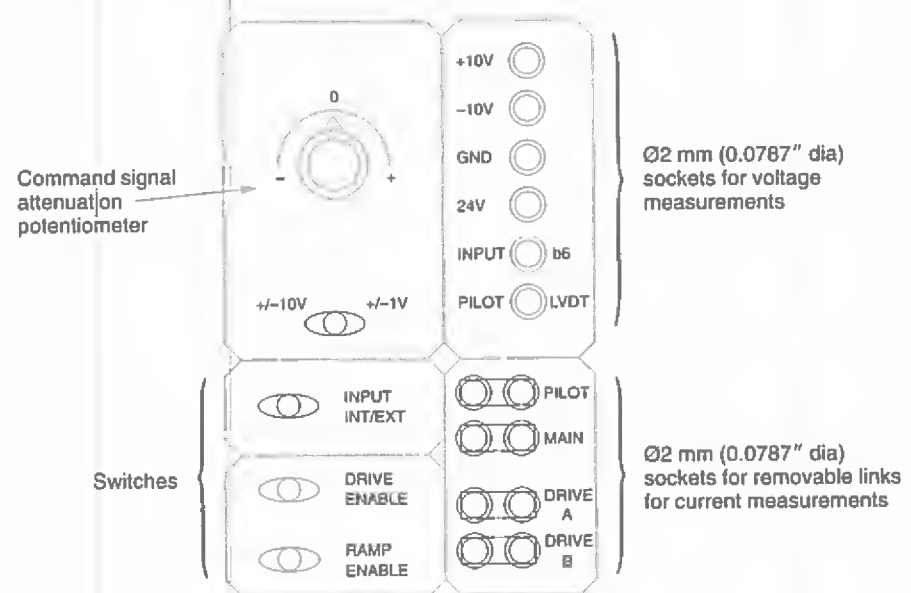
The following parameters can be measured using a separate meter plugged into sockets:

- Supply voltage
- $\pm 10V$  reference voltage
- Command signal
- Current to drive A
- Current to drive B
- Mainstage LVDT output current
- Pilot-stage LVDT output current
- Pilot-stage LVDT voltage

### Input Int./Ext.

With "EXT" selected the amplifier (and hence the valve and actuator) are controlled from the user's control system. With "INT" selected the control signal is derived from the potentiometer on the test equipment.

### Panel Arrangement



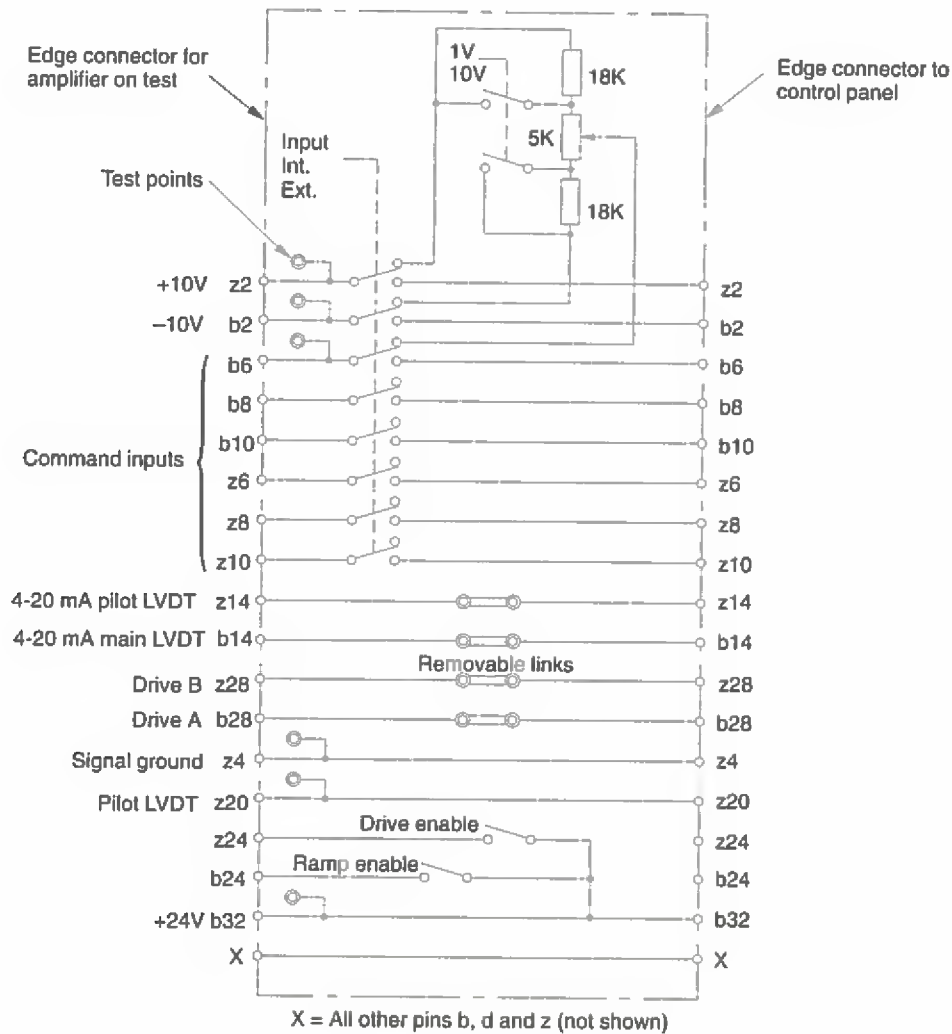
**Warning: Electromagnetic Compatibility (EMC)**

The European Community directives for electromagnetic compatibility (EMC) do not apply to this product.

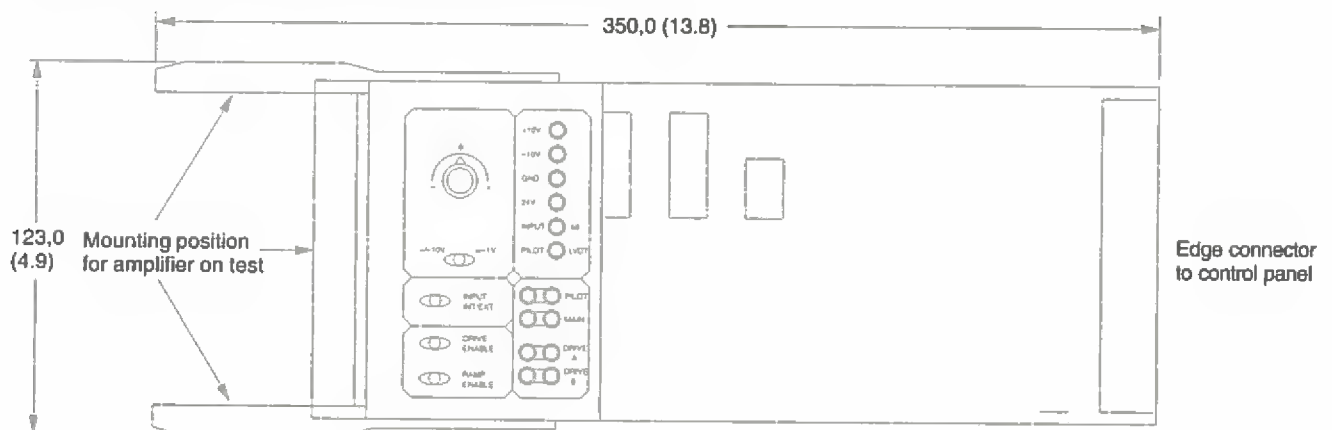
GB-2315



## Circuit Diagram



## Installation Dimensions in mm (inches)



## Auxiliary Function Modules for Proportional Valves

Hydrostat, Parallel-Flow-Path, Pilot Shuttle and Tapping Modules

### Functional Symbols

For typical applications of these modules see next three pages

#### Size 03

Hydrostat module, P to A or B



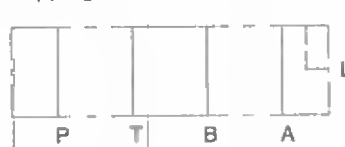
Parallel-flow-path module



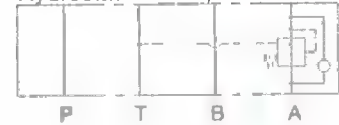
Hydrostat module, P to P



Tapping module

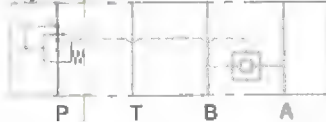


Hydrostat module, A to T

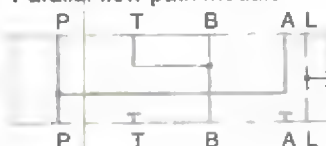


#### Size 05

Hydrostat module, P to A or B



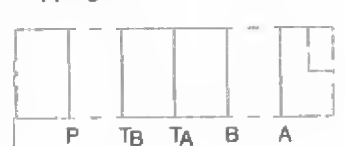
Parallel-flow-path module



Hydrostat module, P to P

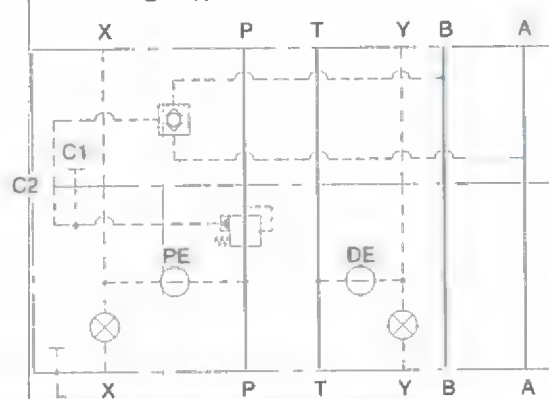


Tapping module



#### Sizes 07 and 08

Hydrostat module with pilot shuttle module. These two modules must be used together.



**Warning: Electromagnetic Compatibility (EMC)**

The European Community directives for electromagnetic compatibility (EMC) do not apply to this product.

GB-2459

# Typical Applications

## Proportional Throttle Valves

### KTG4V-3 example ●

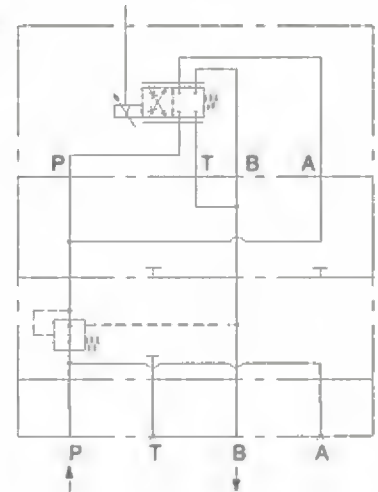
Maximum system pressure with this flow configuration is 210 bar (3000 psi) (maximum pressure for port T).

Proportional throttle valve, typical

Parallel-flow-path module  
KDGMA-3-616265

Hydrostat module, P to P  
KDGMAH-3-616262

Subplate ▼ or other mounting pad



### KFTG4V-3 example ●

Maximum system pressure with this flow configuration is 210 bar (3000 psi) (maximum pressure for port T).

Note: A tapping module (for port L external drain) is required only if pressure at port T exceeds 160 bar (2320 psi) up to the maximum rating of port T, 210 bar (3000 psi).

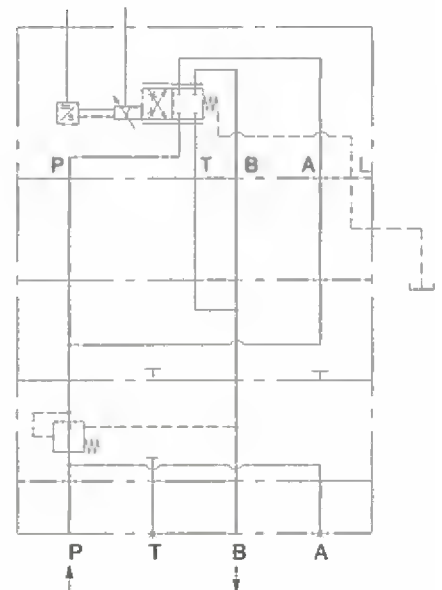
Proportional throttle valve, typical

Tapping module  
KDGMA-3-02-139112-10-R  
or  
KDGMA-3-02-139148-10-S

Parallel-flow-path module  
KDGMA-3-616265

Hydrostat module, P to P  
KDGMAH-3-616262

Subplate ▼ or other mounting pad



- See catalogs 539 and 2466, "Proportional Directional Valves, Size 03".
- See catalog 2425, "Subplates and Auxiliary Connection Plates".

### KFTG4V-5 example ♦

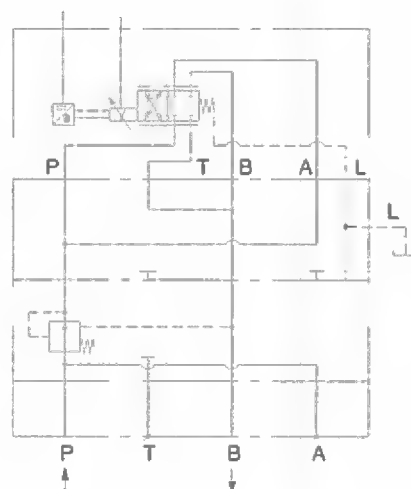
Maximum system pressure with this flow configuration is 210 bar (3000 psi) (maximum pressure for port T).  
For system pressure not exceeding 160 bar (2320 psi) max., port L external drain connection may be plugged.

Proportional throttle valve, typical

Parallel-flow-path module  
KDGMA-5-616877-10-R or  
KDGMA-5-02-139150-10-S

Hydrostat module, P to P  
KDGMA-5-616267 or  
KDGMA-5-616824

Subplate ▼ or other mounting pad



### Single-Stage Proportional Directional Controls

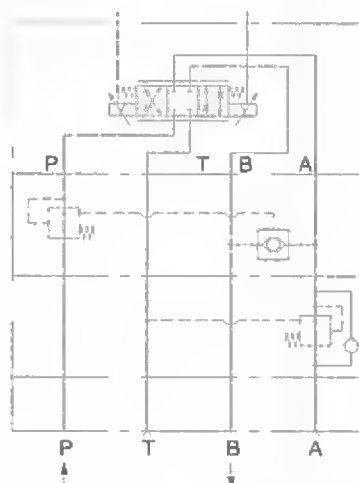
#### KDG4V-3 example ●

Proportional directional valve, typical

Hydrostat module, P to A or B ■  
KDGMA-3-616261

Hydrostat module, A to T ■  
KDGMA-3-616263

Subplate ▼ or other mounting pad



#### KDG4V-3 ● and KDG4V-5 ♦ examples

Note: A tapping module (for port L external drain) is required only if pressure at port T exceeds 160 bar (2320 psi) up to the max. rating of port T.

Proportional directional valve, typical

Tapping module  
Size 03  
KDGMA-3-02-139112-10-R or  
KDGMA-3-02-139148-10-S

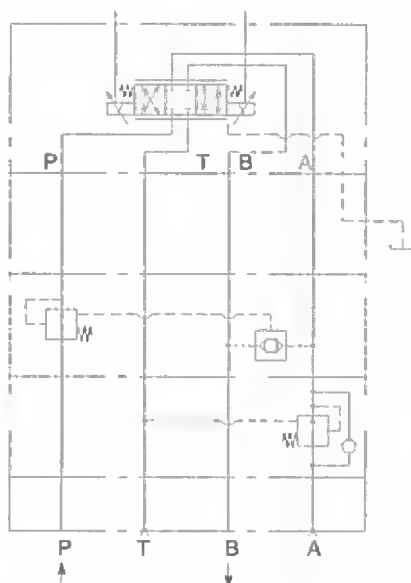
Hydrostat module,  
P to A or B ■  
Size 03  
KDGMA-3-616261

Tapping module  
Size 05  
KDGMA-5-02-139113-10-R or  
KDGMA-5-02-139149-10-S

Hydrostat module P to A or B  
Size 05  
KDGMA-5-616266 or  
KDGMA-5-459062

Hydrostat module, A to T ■  
Size 03  
KDGMA-3-616263

Subplate ▼ or other mounting pad



■ Only one of these two types can be installed in any one stack.

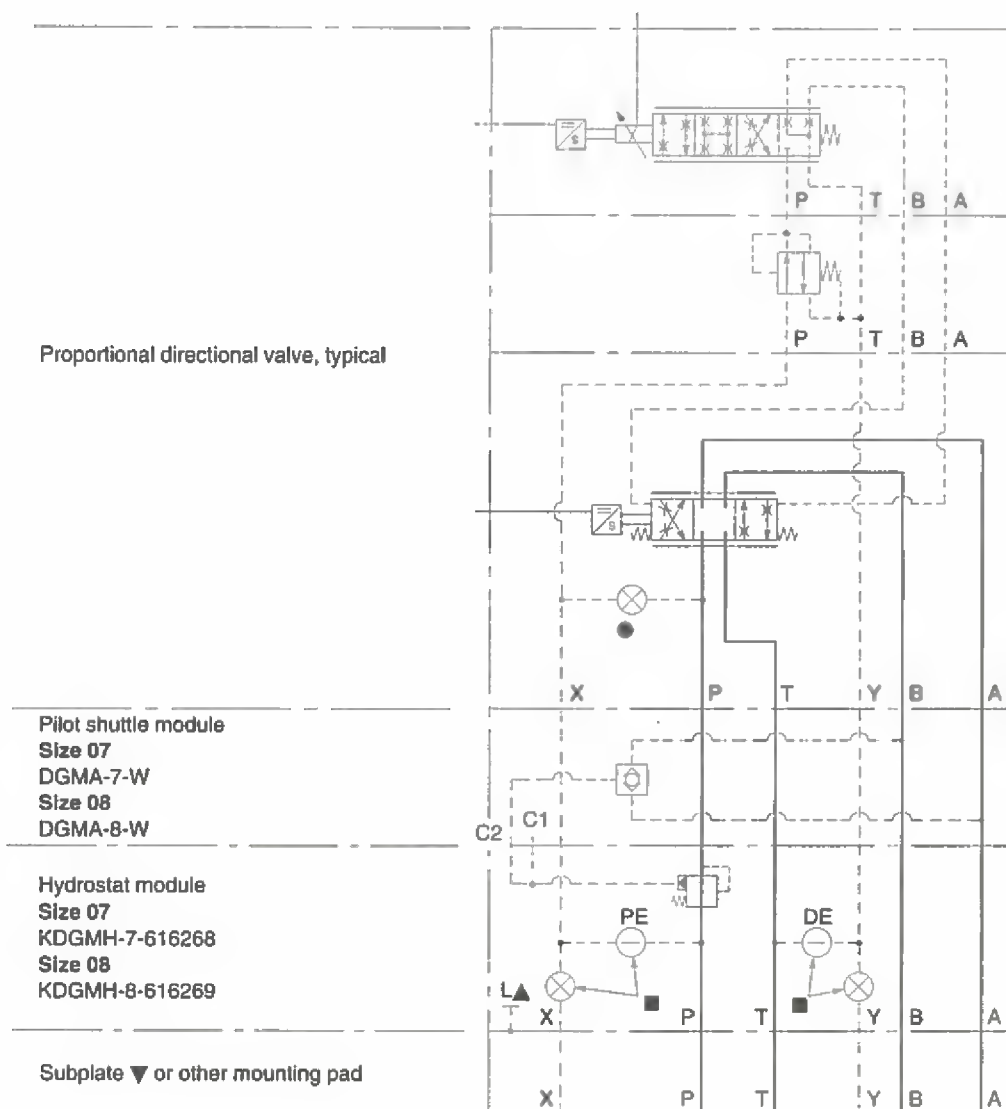
● See catalogs 539 and 2466, "Proportional Directional Valves, Size 03".

♦ See catalogs 2452 and 2467, "Proportional Directional Valves, Size 05".

See catalog 2425, "Subplates and Auxiliary Connection Plates".

## Two-Stage Proportional Directional Controls

KF/HDG5V-7/8 example ■



### ■ Important

Hydrostats are supplied with plugs fitted in ports X and Y (see ⊗). Before installing hydrostats, relocate plug(s) according to valve mode.

(Note that the "Internal drain" option must not be used.)

For internal pilot/external drain mode  
Relocate port Y plug to position DE.

### For external pilot/external drain mode

Relocate port Y plug to position DE.  
Relocate port X plug to position PE.  
See installation drawing for location of plugs.

▲ Blind port, fitted with O-ring.

⊗ Plugged, as supplied, see ■.

⊖ Unplugged, as supplied, see ■.

■ See catalogs 2325 and 2457, "Proportional Directional Valves, Sizes 05, 07 and 08".

▼ See catalog 2425, "Subplates and Auxiliary Connection Plates".

● To be plugged when hydrostat module is used.

## Model Codes

### For Hydrostat Modules

**(F3-)KDGMH- \* -\*\*\*\*\* -1\***



#### 1 Fluid compatibility

Blank = Antiwear hydraulic oil

F3 = Phosphate esters or antiwear hydraulic oil

#### 2 Mounting size code (ISO 4401)

3 = 03

5 = 05

7 = 07

8 = 08

#### 3 Function

KDGMH-3-~~616261~~ = P to A or B control

KDGMH-3-~~616262~~ = P to P control

KDGMH-3-~~616263~~ = A to T control

KDGMH-5-~~459062~~ = P to A or B control

KDGMH-5-~~616266~~ = P to A or B control

KDGMH-5-~~616267~~ = P to P control

KDGMH-5-~~616824~~ = P to P control

KDGMH-7-~~616268~~ = P to A or B control

KDGMH-8-~~616269~~ = P to A or B control

Hydrostat flow ratings and control  $\Delta p$  are detailed in "Max. pressures and flow ratings" on next page.

#### 4 Design number, 10 series ▲

▲ Subject to change. Installation dimensions unaltered for design numbers 10 to 19 inclusive.

### For Pilot Shuttle Modules

**DGMA- \* -W -1\***



#### 1 Mounting size code (ISO 4401)

7 = 07

8 = 08

#### 2 Design number, 10 series ▲

### For Parallel-Flow-Path Modules

**KDGMA- \* , 10 series ▲**



#### 1 Available options

KDGMA-3-616265-1\*

KDGMA-5-616877-1\*-R

KDGMA-5-02-139150-1\*-S

### For Tapping Modules

**KDGMA- \* , 10 series ▲**



#### 1 Available options

KDGMA-3-02-139112-1\*-R

KDGMA-3-02-139148-1\*-S

KDGMA-5-02-139113-1\*-R

KDGMA-5-02-139149-1\*-S

## Operating Data

Max. pressures	See table below
Flow ratings	See table below
Hydraulic fluids: KDGMH hydrostat modules DGMA shuttle modules	See [1] in "Model Codes" Antiwear hydraulic oil or phosphate esters
Installation dimensions	See next page
Mass: KDGMH-3 KDGMH-5 KDGMH-7 KDGMH-8 DGMA-7 DGMA-8 KDGMA-3 KDGMA-5	1,1 kg (2.4 lb) approx. 6,2 kg (13.7 lb) approx. 16 kg (35.3 lb) approx. 30 kg (66.1 lb) approx. 4,1 kg (9.0 lb) approx. 5,6 kg (12.3 lb) approx. 0,5 kg (1.1 lb) approx. 1,5 kg (3.3 lb) approx.
Fastening kits	See catalog 2314

### Max. Pressures and Flow Ratings

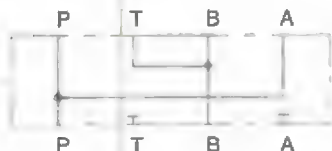
Model	Max. pressure, bar (psi) for ports:					Rated flow L/min (USgpm)	Datum $\Delta p$ bar (psi) for rated flow
	P, A & B	T	X	Y	L		
KDGMH-3-616261 KDGMH-3-616262 KDGMH-3-616263	315 (4567)	210 (3000)	—	—	10 (145)	25 (6.6)	8 (116)
KDGMH-5-616266 KDGMH-5-616267	315 (4567)	210 (3000)	—	—	2 (29)	50 (13.2)	4 (58)
KDGMH-5-459062 KDGMH-5-616824						70 (18.5)	8 (116)
KDGMH-7-616268	250 (3625)	250 (3625)	250 (3625)	5 (72)	—	180 (47.5)	8 (116)
KDGMH-8-616269						360 (95.0)	
DGMA-7-W	Must be placed between K*DG5V-7 directional valves and KDGMH-7-616268 hydrostat modules ▲						
DGMA-8-W	Must be placed between K*DG5V-8 directional valves and KDGMH-8-616269 hydrostat modules ▲						
KDGMA-3	No functional limitations: dependent on valves used						
KDGMA-5							

▲ If both of these are to be used together.



## Installation Dimensions in mm (inches)

### Size 03 Parallel-Flow-Path Module KDGMA-3-616265-1\*

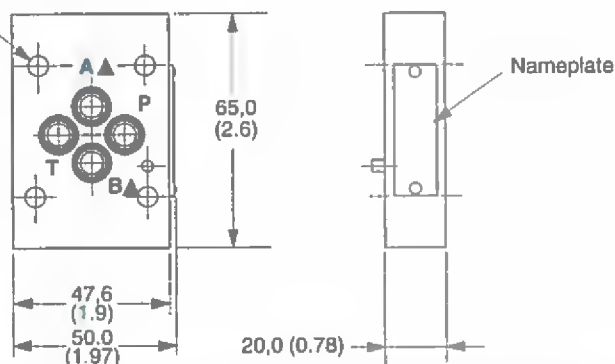


Typically used for doubling effective flow capability of single solenoid proportional valves (throttle valves), as illustrated in "Typical Applications".

▲ A and B ports at subplate face are blind holes fitted with O-seals.



4 holes Ø5,6 (0.22 dia),  
counterbored to Ø9,5 (0.374 dia)

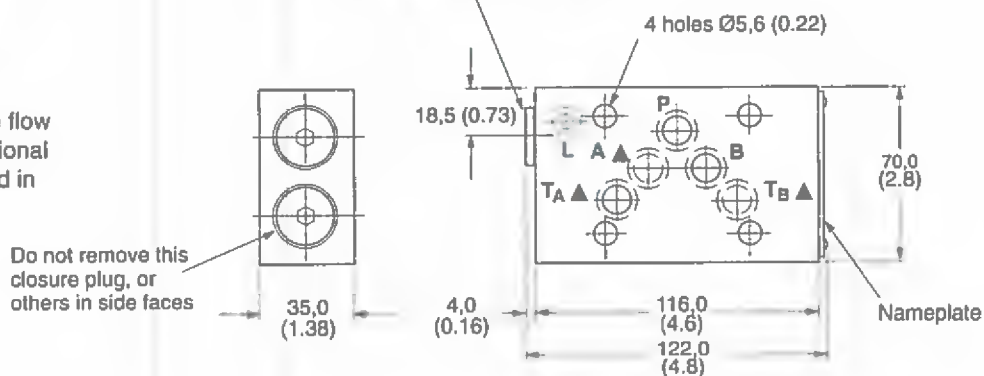


### Size 05 Parallel-Flow-Path Modules KDGMA-5-616877-1\*-R KDGMA-5-02-139150-1\*-S



Typically used for doubling effective flow capability of single solenoid proportional valves (throttle valves), as illustrated in "Typical Applications".

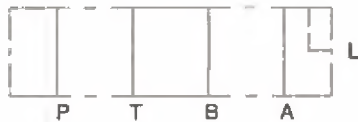
Supplied with port L plugged. Remove plug for external drain connection if required.  
(See table for tapping and socket A/F sizes)



▲ A, T<sub>A</sub> and T<sub>B</sub> ports at subplate face are blind holes fitted with O-seals.

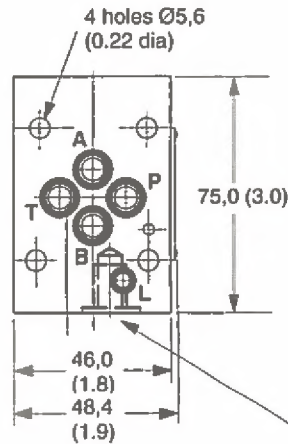
Model	Port L thread	Socket wrench A/F for plug removal
KDGMA-5-616877-1*-R	G <sup>1</sup> / <sub>4</sub> (1/4" BSPF) × 11,0 (0.43) full thread depth	6,0 (0.23)
KDGMA-5-02-139150-1*-S	9/16"-18 UNF × 12,7 (0.5) full thread depth	6,3 (0.25)

**Size 03 Tapping Modules**  
**KDGMA-3-02-139112-1\*-R**  
**KDGMA-3-02-139148-1\*-S**  
**Port L Tapping Plates**



Provide external drain connection where port L is not present in subsequent stackable valves or in subplate/manifold block, e.g. in retro-fit work. Typically used for proportional and other valves having the port L drain connection, e.g.:

K(A)FDG4V-3  
 K(A)FTG4V-3  
 K(A)SDG4V-3



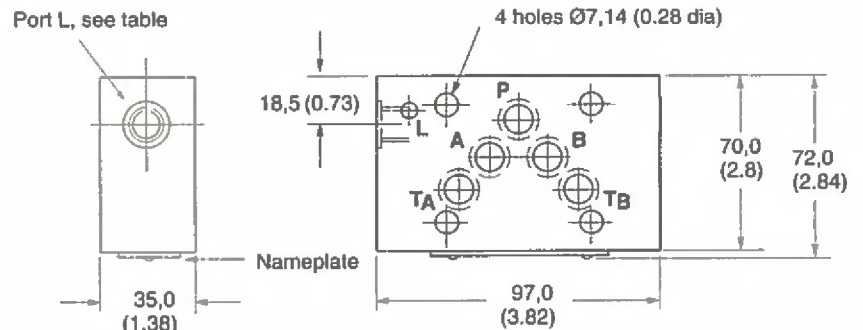
1 tapped port:  
 For KDGMA-3-02-139112-1\*-R, G<sup>1</sup>/<sub>8</sub>" (1/<sub>8</sub>" BSPF)  
 For KDGMA-3-02-139148-1\*-S, 7/<sub>16</sub>"-20-UNF-2B  
 (SAE) (for 1/<sub>4</sub>" O.D. tubing)

**Size 05 Tapping Modules**  
**KDGMA-5-02-139113-1\*-R**  
**KDGMA-5-02-139149-1\*-S**  
**Port L Tapping Plates**



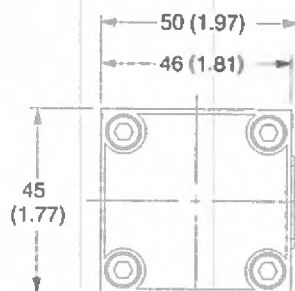
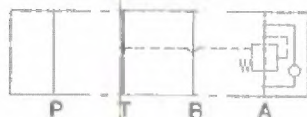
Provide external drain connection where port L is not present in subplate/manifold block, or in subsequent stackable valves, e.g. in retro-fit work. Typically used for proportional and other valves having the port L drain connection, e.g.:

K(A)FDG4V-5  
 K(A)FTG4V-5



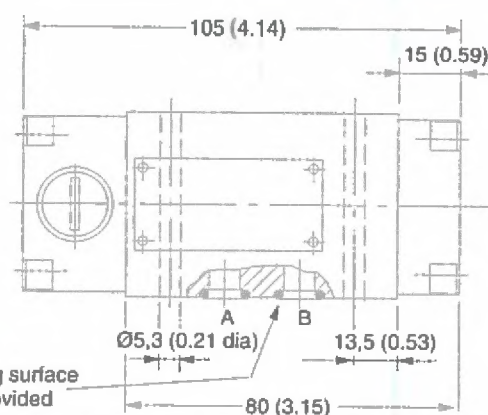
Model	Port L thread
KDGMA-5-02-139113-1*-R	G <sup>1</sup> / <sub>4</sub> " (1/ <sub>4</sub> " BSPF) x 11,0 (0.43) full thread depth
KDGMA-5-02-139149-1*-S	9/ <sub>16</sub> "-18 UNF x 12,7 (0.5) full thread depth

**Size 03 Hydrostat Module  
KDGMH-3-616263**

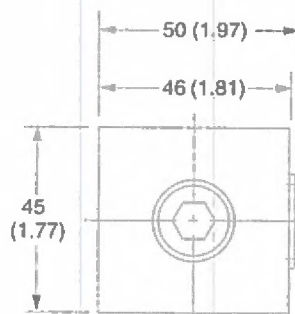


A and B  $\varnothing$

Mounting surface  
seals provided

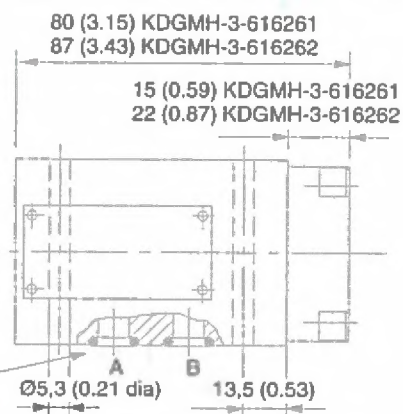


**Size 03 Hydrostat Module  
KDGMH-3-616261**

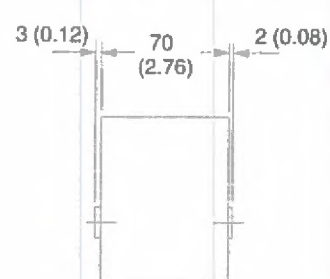


A and B  $\varnothing$

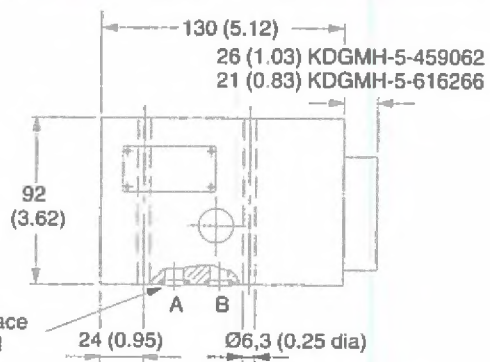
Mounting surface  
seals provided



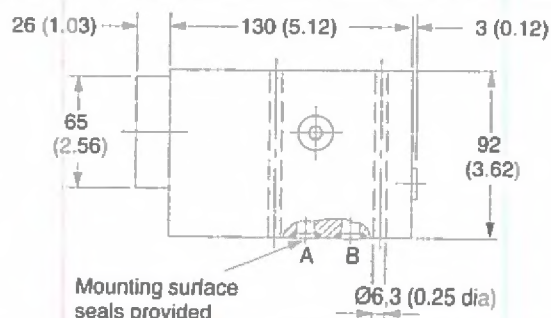
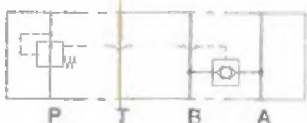
**Size 03 Hydrostat Module  
KDGMH-3-616262**



Mounting surface  
seals provided

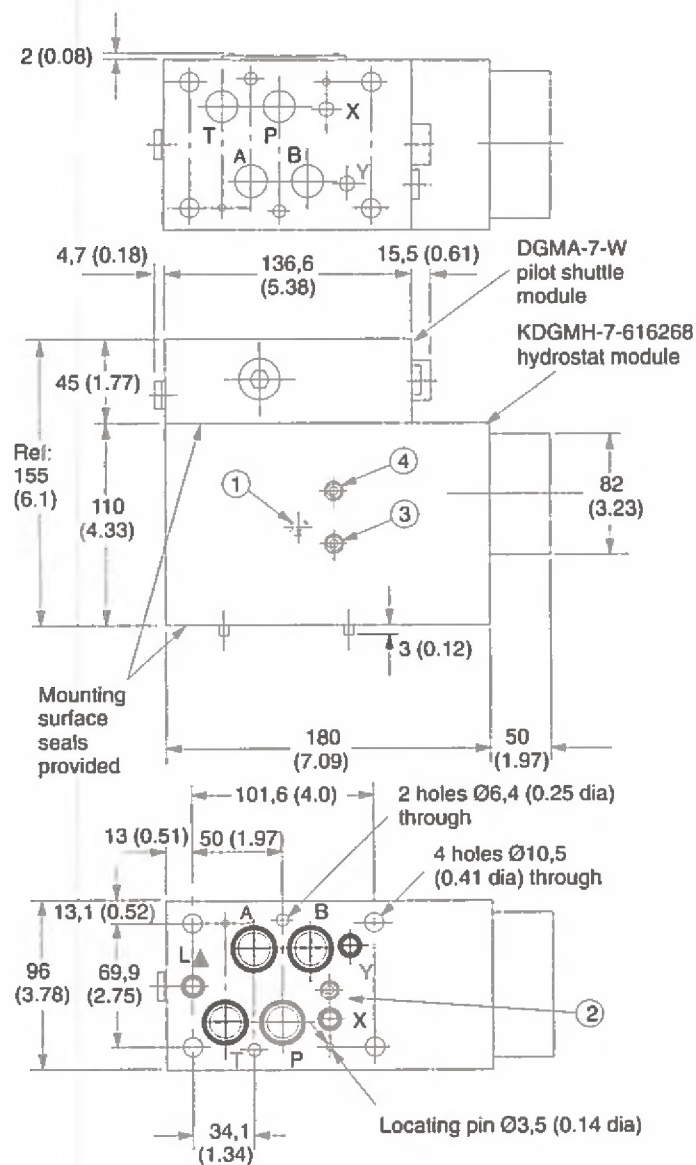


**Size 05 Hydrostat Modules  
KDGMH-5-459062 and  
KDGMH-5-616266**

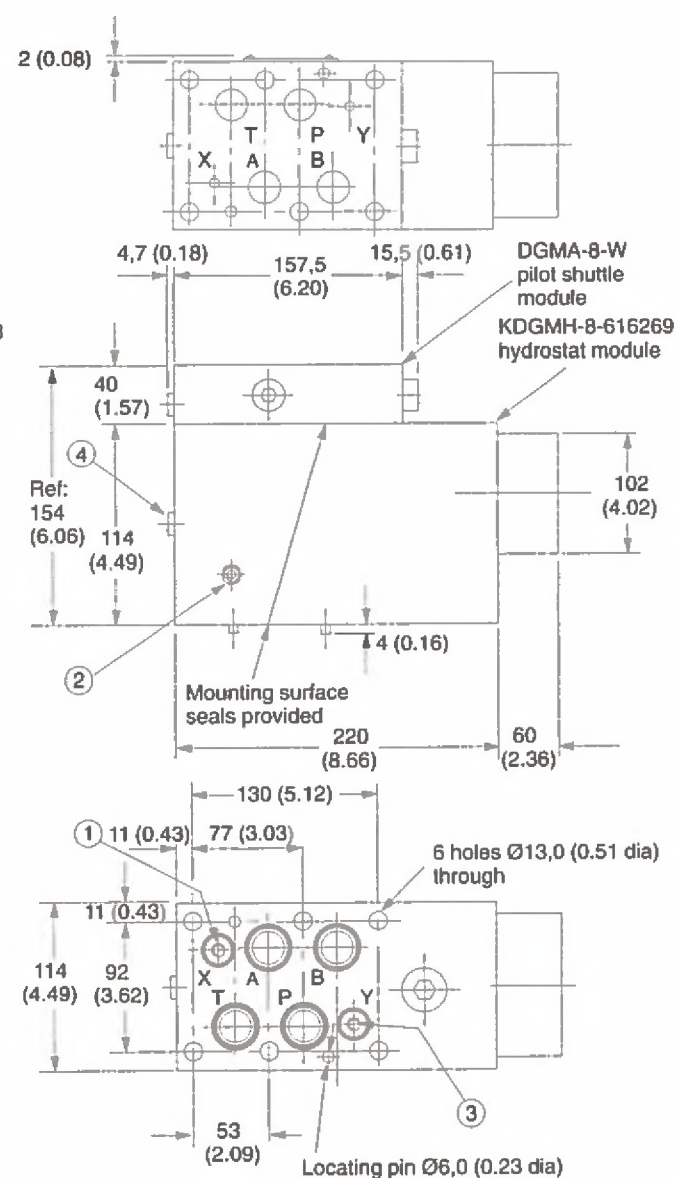


Mounting surface  
seals provided

**KDGMH-7-616268 Hydrostat Module  
with DGMA-7-W Pilot Shuttle Module**



**KDGMH-8-616269 Hydrostat Module  
with DGMA-8-W Pilot Shuttle Module**



**Pilot Pressure and Drain Conversions**

See "Important" note on page C.163 then relocate plug(s) to suit required operating mode as below.

Condition (◆)		Plugs ■	
Pilot pressure	Pilot drain	Fitted	Omitted
As supplied		① ③	② ④
Internal (P)	External (Y)	① ④	② ③
External (X)	External (Y)	② ④	① ③

Operating modes

- Hex. sockets in plugs for:  
KDGMH-7 ..... 4 (0.155) A/F  
KDGMH-8 ..... 5 (0.196) A/F  
Torque to hand-tightness.
- ◆ Effective port in main-stage mounting surface.
- ▲ Blind port.



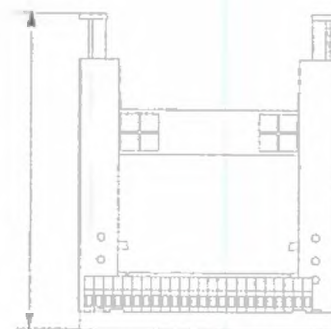


## Electronic Accessories for Proportional Valves with Associated Power Amplifiers

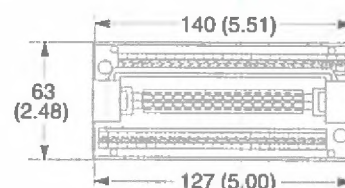
### Amplifier Cardholder

- Version with female edge connector type D32 (Order number 02-104806)
- Version with female edge connector type F32, rows b and z only (Order number 02-104807)
- Version with female edge connector type F48 (Order number 02-104808)

The cardholder is fitted with a DIN 41612 female edge connector type F32/48, having screw terminals that facilitate fast, secure wiring connections. The amplifier cards clip into the cardholder to prevent them from accidentally working loose.



D32=158 (6.22)  
F32, F48=169 (6.65)

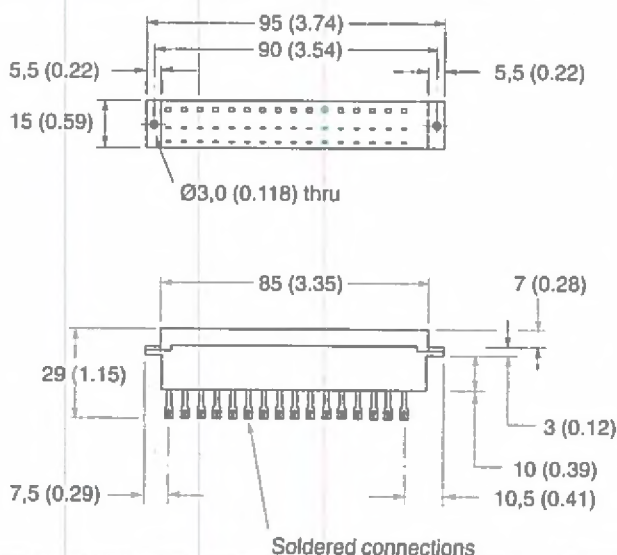


### Female Edge Connector for 19"

#### Rack Mounting

#### Order number 508178

This DIN 41612 type F48 connector is fitted with solder terminals. The connectors can be user-installed in a 19" rack housing and are designed to accommodate all the amplifier cards.



Soldered connections



**Warning: Electromagnetic Compatibility (EMC)**

The European Community directives for electromagnetic compatibility (EMC) do not apply to these products.

GB-2460A